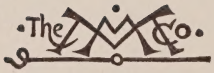
SEX

FOR PARENTS AND TEACHERS



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The Metropolitan Museum of Art

THE STORM.
By P. A. Cot, 1880

Biol.
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SEX

FOR PARENTS AND TEACHERS

BY

WILLIAM LELAND STOWELL, M.D.

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ILLUSTRATED

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This little volume is affectionately dedicated to MY MOTHER, who explained to me the wonders of birth and motherhood when I was yet a little lad.

. . . . "lo, a life unrolled!
In woven pictures all its changes told."

Holmes.

FOREWORD

The subject of sex is one of vital importance to every intelligent person. It is equally important to the ignorant individual although he may not be so well aware of the fact. Sex is intimately related to the best in painting and sculpture, is interwoven in the finest literature, if it is not its predominant feature, and is the motif in music whether it be the gallant's serenade or the opera Carmen. It is the controlling impulse or cause of man's best efforts in many departments of life, and also at the bottom of the basest and least desirable of human activities.

Because of the seamy side of the subject, fastidious members of society have been inclined to maintain silence regarding sex matters, while persons of low tastes have flaunted their vicious knowledge, thus indicating that one's views relative to sex depend largely upon previous education or lack of it. According to Professor James, "Education is the organization of acquired habits of action and tendencies to behavior which shall fit him (the child) to his social and physical world;" and further "it is the making over of experience and giving it a more sociological value through increased individual efficiency or better control over one's powers" (John Dewey). The foregoing statements while general in character may be specifically applied to our present subject, sex.

Parents hesitate to inform their children of their

origin and of their developmental changes partly because of modesty, but in most instances on account of limited knowledge concerning anatomy and physiology and a consequently limited vocabulary. The teaching of the young child should be commenced as early as it asks for information on any subject, but this can not be properly done until the parent and teacher have been instructed.

A visit to the library of the board of education of one of our largest cities disclosed the fact that it contained no books treating of sex physiology or sex hygiene. A visit to the public library showed that the card index of books pertaining to sex were black from constant usage. Much of the use of such books is doubtless the result of morbid curiosity or state of mind; but had there been wiser teaching in the past, it would not be so urgent now.

The youths of our homes and schools have been spending too much time in the study of dead languages and too little in honest endeavor to comprehend living impulses. Each department should receive its proper share of attention, but not to the exclusion of the other. A candid and open study of the wonders of life and its origin will go a long way toward overcoming morbid curiosity. We explain seeing and hearing, we show how the circulating blood is purified by our breathing, we give instruction in hygiene as regards exercise and rest, the food we should eat, the need of cleanliness to avoid infections, etc., why not discuss sex problems in the same spirit? Without sex functions there would be no others to discuss.

A knowledge of the facts of physiology is essential

to the proper care of the body, and truth is essential to the training of the mind; ignorance or erroneous information may lead to disease of one and to disorder of the other.

A right-minded girl with a clear understanding of her organs and herself has a sense of her importance to the race; a right-minded boy equally informed has a sense of responsibility and respect for the opposite sex, and develops chivalry and courtesy in his treatment of his own or another's sister.

It is the general opinion of American educators that the biological approach is the method best suited to the successful teaching of sex subjects. Biology can be studied readily at home, in the park or museum if farm or forest are not near. The information to be gained depends upon the care with which observations are made and upon the good judgment used in interpreting the findings.

The relations of men and women in matrimony or as celibates and their views regarding morals, personal liberty, etc., can no longer be regarded as private matters; the nation is alive to the fact that the subject of sex involves illegitimacy, heredity, efficiency in work and war, quality and quantity in race increase, length of life of children and adults, insanity, feeble-mindedness and many sociological factors.

The Government learned much from the world war concerning the health and habits of men. As a result, in 1918 Congress established the Interdepartmental Social Hygiene Board and appropriated $4,000,000 for a period of two years. They are now disbursing $300,000 a year to thirty colleges and schools in an

attempt to develop Departments of Hygiene. These statements should make clear to the reader that our people are awake to their needs and opportunities, hence the social health propaganda.

In order to make this subject clear and the task of teaching it a pleasant one, the author has written this book. We shall begin by noting the methods of reproduction in flowers, then consider the more evident combination of sexes as seen in fishes and birds; and after some reference to a few of the higher animals we shall pass to the physical and mental differences to be observed in man and woman from puberty to maturity and beyond. This will include a study of the many glands influencing sex functions as well as the reproductive organs. Other topics treated will be, marriage, morality, diseases of the sex organs, heredity, eugenics and euthenics.

The author aims to be scientifically accurate in statement without being unduly technical. While the biological method is pursued there is no reason why we should not call to our aid the artist and sculptor. Think of the majesty and dignity of the human form as presented to us with consummate power by Michaelangelo, and the simple naturalness and beauty of the figures of Rodin. The free use of illustrations will appeal to many persons who retain better the impressions received through the eye than those derived through reasoning.

By careful reading of the book, one may become acquainted with assembled facts not readily obtainable elsewhere. It is hoped that the advice will prove helpful in developing strong bodies, the precepts aid in

perfecting character and that the total effect will be to emphasize a system of morals that is the best for the individual and for society.

I am glad to acknowledge valuable suggestions from many friends and many authors. I am indebted to my devoted wife and to our sons for much kindly criticism and encouragement throughout the preparation of this work, especially to Mr. Kenneth who made many of the drawings. My thanks are also due Ruth K. Stowell, Principal, and to my friend Mr. C. F. Goddard for editorial revision. Finally I am under deep obligations to the publishers for their courtesy and co-operation in producing the book.

WM. L. STOWELL.

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INTRODUCTORY NOTE

THE author has kindly allowed me to look over the page proof of this book, and I am glad to express my appreciation of the sane and sensible way in which he has treated a subject which in delicacy, difficulty and importance is surpassed by no other. The sense of its importance and the necessity of knowing and teaching it have been growing upon the public for a decade and a half, and the war served as an object lesson to bring its significance home to every community as no other event in history has done, so that we now have a new freedom in thinking and speaking of such subjects, even among the young; while the gradual breaking down of old taboos and pruderies that hedged it in, and the new light which science has shed upon it have incalculably increased the interest of the public in it and given us a new revelation of its bearings upon every aspect of life—individual, community, and the future. The author very wisely selects the biological approach and writes in terse language and with well chosen illustrations, many of them here published for the first time, showing the significance of sex in the world of plants, insects, fish, birds, and mammals, up to man.

Without giving any offensive prominence to acts and organs, the essentials of what every parent and teacher should know concerning these are epitomized, together with elementary embryological data. The writer sifted from highly specialized fields the main features of Weismannism and the facts of heredity

along with the Mendelian laws so well illustrated in the production of degenerates; hormones and endocrine functions, while eugenics, which Galton called the religion of the future, is set forth in a wholesome pedagogic way, and throughout the ethical, æsthetic, moral and even religious importance of all these topics is well brought out. He has wisely, in my opinion, said little about Freud and his psychoanalysis, which, although it has a message of great scientific and therapeutic significance is for experts and not for those here addressed.

I have followed this subject of Sex Education for many years and have a very extensive collection of its literature, very much of which seems to me positively misleading, often quite erroneous as to facts, which are often smothered in sentiment, far too diffuse, and sometimes omitting altogether some of the most essential practical points—errors which the present writer seems to avoid.

We must, no doubt, always rely, first of all, upon physical culture and bodily training, in which the draft statistics showed such amazing shortcomings among our young men. A close second of this must be interests, zests, enthusiasms, which set a backfire to lust. Young people must glow and tingle and have excitement, and if they can not obtain this normally in intellectual, æsthetic, and motor ways, they are prone to have their calentures in the sensuous field. This, too, the author recognizes. For these reasons I am glad of the opportunity of giving his book my heartiest Godspeed.

G. Stanley Hall.

Clark University, March, 1921.

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SEX EDUCATION

The critic fears a discussion of sex lest undue sex-consciousness be awakened. That need not disturb us. The musician that studies harmony and rhythm must have a better appreciation of the opera and oratorio than has a person who plays only "rag time." In like manner the individual that gives careful thought to sex must more thoroughly realize the wonders and beauties of nature in providing for continuance of the species than does the careless traveler that goes unheedingly through life. The understanding of physiology will not take the place of character; that must be cultivated to grow. A study of sex problems will help the reader in appreciation of life in proportion to his or her present knowledge and seriousness of purpose. If some readers are shocked, it cannot be helped. We, in large measure, get from books or scenes what we put into them. Children, for example, are unabashed at that which would discomfit adults who may have acquired a sense of guilt or shame. It may be true that "That would have made Quintillian stare and gasp"; it is also true that we should clear the mists so far as possible and substitute an intelligent respect for the marvellous processes by which we were created.

Flaubert said "There are no beautiful thoughts without beautiful forms, and conversely." True enough, therefore let us train ourselves and our youths to associate beautiful thoughts and deeds with beauty of form.

The object of education is to make for service to humanity and happiness for ourselves and our children, *i. e.*, posterity. Words alone may give us sensible and correct images but there is no doubt that the illustration can often help to fix a fact better in our mind.

Very young children ask endless questions. That is the way they learn about this marvellous world. They soon ask whence they came if not where they will go. As they grow older it is instinctive to want to know something of the origin of life, and later on of sex problems in various phases.

They should be given honest answers, the completeness and detail of which will depend upon the age and understanding of the child. Evasive replies excite suspicion and arouse the curiosity, leaving the questioner unsatisfied and the questioned person with an opportunity for helpfulness, lost.

Ignorance is excusable in the young person, but not in the mature man or woman. The spiritual beauty of sex ideals cannot be inculcated by merely handing to the youth mysterious pamphlets. The teacher, parent or physician should be able to answer questions and give advice, regarding sex matters with the same candor and directness used in discussing digestion or the circulation of the blood. It is true that many persons cannot do this, partly from their own lack of understanding, partly from an artificial modesty that they have allowed to develop. There is no blush in

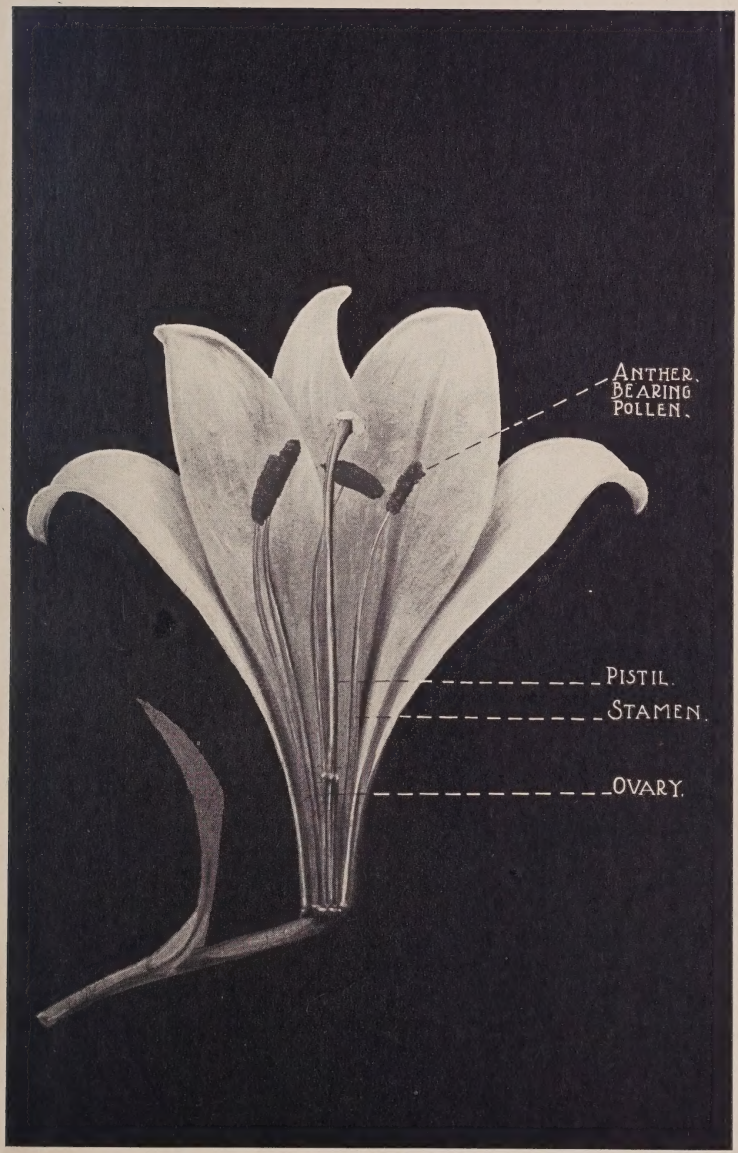


Plate I. Easter Lily showing the sex parts of a flower; the ovary and pistil, female; the stamens, anthers and pollen, male.

nature in regard to sex or its consequences. Imagine a rose embarrassed or butterflies blushing or any of our domestic pets and animals ashamed in perpetuating their kind. They all fulfill the requirements of their natures and in turn reproduce the species for our admiration and use.

Sex has long remained mysterious and by many persons has been considered sacred, as marriage is one of the seven sacraments in the Roman Catholic Church. Teachers always praise honor, justice and charity, but hesitate to lay equal stress on chastity, one of the highest social virtues.

In the beginning of our study let us rid ourselves of the notion that "sex" is an undignified or vulgar word. It is as honorable as any word in our language. According to Webster, sex is from the Latin *sexus* and signifies "the sum of the peculiarities of structure and function that distinguish a male from a female organism; the character of being male or female, or of pertaining to the distinctive function of the male or female in reproduction." Sex is manifested in other than anatomical and physiological differences; in the higher animals in addition to the special reproductive organs there are mental and temperamental variations, psychological characteristics. The essential attribute of a male is the production of sperm cells, spermatozoa; the essential quality of a female is the generation of eggs or ova.

A proper study of sex will cover many phases of a great subject, important to the individual, whether young or old, and of great moment to society and the race now present and to come.

The youth of our land whether in field or in factory, in college or in home, need help to solve difficulties and perplexities concerning themselves primarily, and secondarily their fellows, male or female. The science of preserving health is termed Hygiene. Sex hygiene, therefore implies a clean healthy individual; social hygiene implies a healthy community, many problems of which are not directly concerned with reproduction.

To the right minded, a study of sex relationship and influences should be ennobling and a stimulus to higher aims and endeavors. An honorable young man will do or bear anything for a young woman of like type. The better the young men and women understand themselves and their functions, the better can they control desires and actions and so adjust themselves to social and economic relations.

Sex instruction should be begun with very young children; when they are old enough to be interested in flowers or vegetables they can be taught and shown how plants come from seeds. Seeds like corn and beans may be sprouted in any home by keeping them in moist sand or cotton. The seeds in fruits may serve for talks to our little folks who will plant them and watch the unfolding with great interest.

Household pets, birds, cats, rabbits, dogs, chickens, cows, etc., according to circumstances, give opportunity for observations on mating and parentage. A child who has been taught to observe and think comes imperceptibly into much sex knowledge without knowing when or where.

Questionnaires show that children get their first definite sex information as early as six or seven years and

nearly all before the changes incident to puberty. Many times the information is given by ignorant servants, often by companions older but uninformed, and in cases not a few by persons directly vicious.

Much depends upon the attitude of mind formed in young people concerning personal and public relations. Therefore a great responsibility rests upon the wise and mature, that they give to the young the benefit of their observation and experience. Experience is a great teacher, therefore the young should be informed of the experiences of the old.

It is but human to make mistakes in life, so let the wise encourage the unwise in ways of living that will take them around moral morasses and away from quicksands of iniquity. Self control should be cultivated in all character building, especially in the department of sex sense. Unbridled sex desires become lust, which according to the older theologians was one of the mortal or deadly sins.

Farther on in this little book we shall endeavor to give a clear account of the biology of reproduction, but neither that nor laws will insure purity. To knowledge of life's processes and the law's provisions, must be added moral strength and courage. Pope tells us that "vice is a monster of so frightful mien, as to be hated needs but to be seen." Quite true, but vicious tendencies may creep in unseen unless we are always definitely cultivating high standards. "We need control of, not annihilation of instincts." "Masculine virility needs to be raised to affection, and feminine affection to devotion, and both to greater spiritual heights."

Bigelow says sex education "will bring to many a man and woman a deeper, nobler, and purer knowledge of what sex means for the coming race, and what it means now to each individual who realizes life's fullest possibilities in conjugal affection, which culminates in new life and new motives for more affection. Such an understanding of sex relation to home life will help this old world more than anything else which sex education may accomplish." From *Sex Education*, a most wholesome book for any reader.

Most persons are looking for certain measures of health, wealth and happiness. Those who are moral will be most sure of sexual health; and health is equivalent to wealth; those having health and wealth will be happy personally and bequeath happiness to posterity.

Silence regarding sex matters has proved a failure so far as helping individuals is concerned or lessening social evils. The silence in many quarters may have been due to ignorance, but at the present time must be ascribed usually to cowardice. Intelligent physicians and educators know that there are problems to be solved, but not all are ready to grapple with them. Certainly, knowledge of sex facts should be a help to right conduct.

A youth who has been properly instructed from early childhood will have a general understanding of fertilization of plants and reproduction of animal life without giving special thought to sex knowledge. Under ideal conditions one should give no more concern to sex affairs than to breathing. It is only because this field is so often passed by on the other side, even by

books on hygiene, that there is excuse and need for sex books.

Nature study is much in vogue at present, and it is well that it is so; yet many teachers fail to give the needed attention to the study of the reproduction of the species. Here is an opportunity to make clear the wrongfulness of destroying birds during the nesting season, of hunting deer or rabbits that are bearing young or nursing them. A little judicious counsel as to pets and lower animals will develop a natural respect for motherhood and parentage that may save an awkward situation later on.

Definition of Sex.—Sex is the distinction of the characters of male and female, primarily as to the reproductive organs, though in man there is psychology as well as physiology to be considered.

PLANT REPRODUCTION

Reproduction of plants is brought about by outside agencies, while that of the lower animals is due to instinct. Human life depends for reproduction not upon instinct alone, but upon choice of a mate, implying higher qualities, as love and affection.

One of the finest flowers to study is the Easter Lily as photographed on the opposite page, Plate I. The names at the side clearly indicate the various parts. The female portion, the pistil, stands erect in the middle of the flower starting from the ovary below, and ending above in the broadened top covered with honey to attract insects. The stamens, the male portion of the flower, are arranged around the pistil each bearing at its top the anther which contains the pollen grains. Because the stamens are shorter than the pistil, the flower is not likely to be self-pollinated. The pollen cells are like minute corrugated wheat grains which under the microscope seem to be burnished gold. It is hard to imagine anything more beautiful. Plate II shows the pollen grains magnified two hundred fifty diameters and colored in tint near to nature.

Not all homes contain a microscope, but most schools now do and physicians generally have them. Young people as well as old may get great pleasure and profit by observing more closely many objects which now are passed by with only a glance if not with disdain.

All forms of life begin in germ cells. The tiny grass seed begins the life of a single spear; the acorn holds the

germ cell from which grows the stately oak, an inspiration and shelter to mankind. One seed produces one offspring. The one seed is produced by the union of two sex cells, that is by fertilization.

Pollination.—In plants pollination is accomplished at times by the wind, as in grasses; or by insects, as bees that fly on sunny days gathering honey and so carrying pollen on their legs from the stamens of one flower to the pistil of another. In the same manner moths fly at night, from bloom to bloom thrusting their long tongues deep down for nectar for themselves, and at the same time carrying off pollen dust that will adhere to the next sticky pistil they may come against. Flowers that are fertilized by night-flying insects are usually nearly white, whereas those pollinated by day-flying insects are of bright colors.

Birds like the humming-bird flitting from blossom to blossom convey pollen on their long bills.

Pollen is the male element. This must be deposited upon the stigma of the pistil (female), then make its way down through the style until it reaches the ovule at the base. When a pollen grain rests upon the moist stigma, it begins to form a small tube which proceeds downward by a process of growth or absorption due to a ferment, an enzyme. The tube contains two nuclei, one the tube nucleus which later disappears, and the essential *generative nucleus* which divides into two before it reaches the ovule. Having arrived at this goal there is union of one of the generative nuclei with the nucleus of the egg cell in the ovule, thus forming the embryo of a new seed.

The subject of seeds may be made very interesting to children if they are told how the peapods are cradles

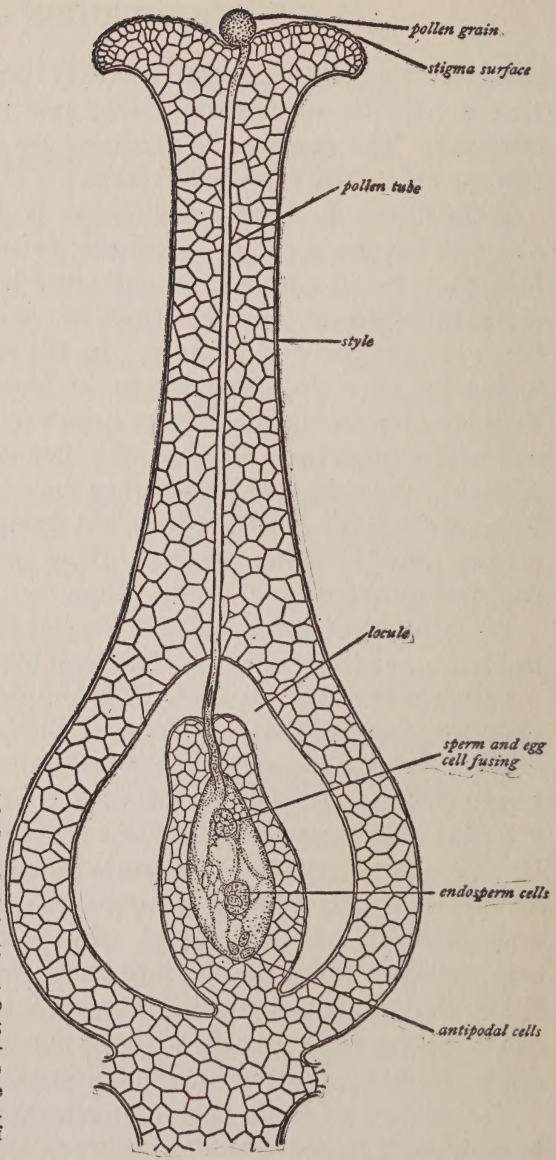


Figure 1. Section of a flower pistil to illustrate fertilization. Note how the pollen passes from the top (stigma) down the middle of the style until it reaches the ovary below; there the pollen (sperm) and egg unite to form a seed. By courtesy of E. H. Eddy.

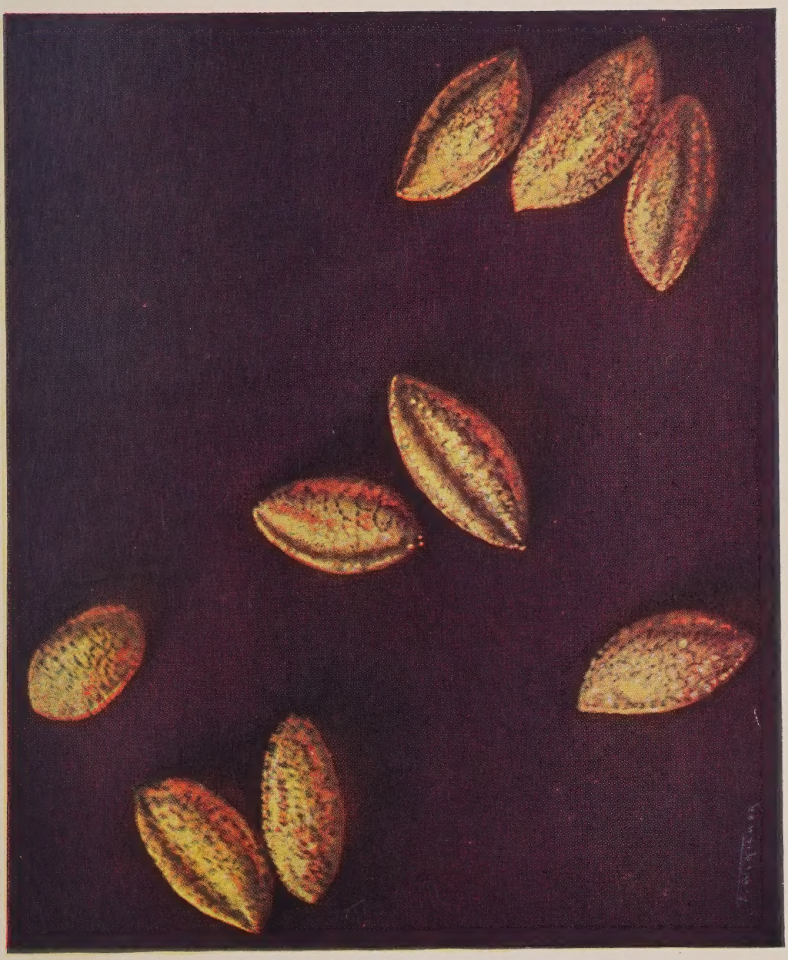


Plate II. Pollen grains of an Easter Lily.
Microphotograph magnified two hundred fifty diameters.

for the peas; how the shell covers the kernel of the nut, which is the seed; how chestnut burrs keep the nuts from injury until they are thoroughly ripened and opened by the frost, etc. A resourceful, thinking adult can set a child to observing many things. Explain how the apple seeds are protected in the middle of the apple, how the peach because it is so luscious is carried far, yet the seed is protected by a shell, etc.

We chose the lily because of its beauty; now let us study corn, an American plant of some beauty and great value because it is so freely grown and forms so large a part of our diet as well as that of our domestic animals. A commodity of which we produced more than three billions of bushels in one year must be worthy of attention. The tassels at the top of growing corn are really flower clusters containing the stamens on which the pollen forms. It is estimated that there are 50,000,000 pollen grains on an ordinary plant of corn. Here is a botanical illustration of the liberality of nature. The cob forms at the side of the corn stalk about two feet from the ground. On the cob, there may be six hundred or eight hundred minute kernels (ovules) each with a "silk" thread which is the style and stigma ready to receive a particle of pollen dust from the tassel above or from a neighboring plant. Farmers find it better for the crop to have cross pollination. That is pollen from one plant is deposited on the silk (styles and stigma) of another plant. Self pollination is the union of pollen and silk growing upon the same stalk. A corn plant bears both male and female flowers; it is therefore monoecious, meaning of a single household.

The corn in the illustrations, Plate III and Figure 2, was taken from the author's "war garden." A small grass plot in a city back yard was put under cultivation, and produced food for thought as well as for the table. The small ear on the right (Plate III) shows conditions before fertilization, that is marked immaturity. The ear on the left is mature, and the silk having fulfilled its office is now to be seen drying up. Notice near the bottom of the full ear two kernels that are very thin and not worth while, because no pollen came down to their aid. They were not fertilized, therefore did not grow. Ovules alone are valueless, they must be fertilized to be fruitful. The two ears suggest Pharaoh's dream of the seven rank and good ears contrasted with the seven lean ears blasted by the east wind. Just so the ova, eggs, of bird or beast do not develop unless fertilized. Plants require a great amount of moisture because it is the constant pressure of water in the cells that produces a fullness or turgor sufficient to keep the plant erect. Without water the plant wilts and may die. Plants build up and store nourishment for animals and man. Man is the consumer and destroyer.

Having considered the lilies of the field, how they grow, though they neither toil nor spin, let us turn to the insects who do both.

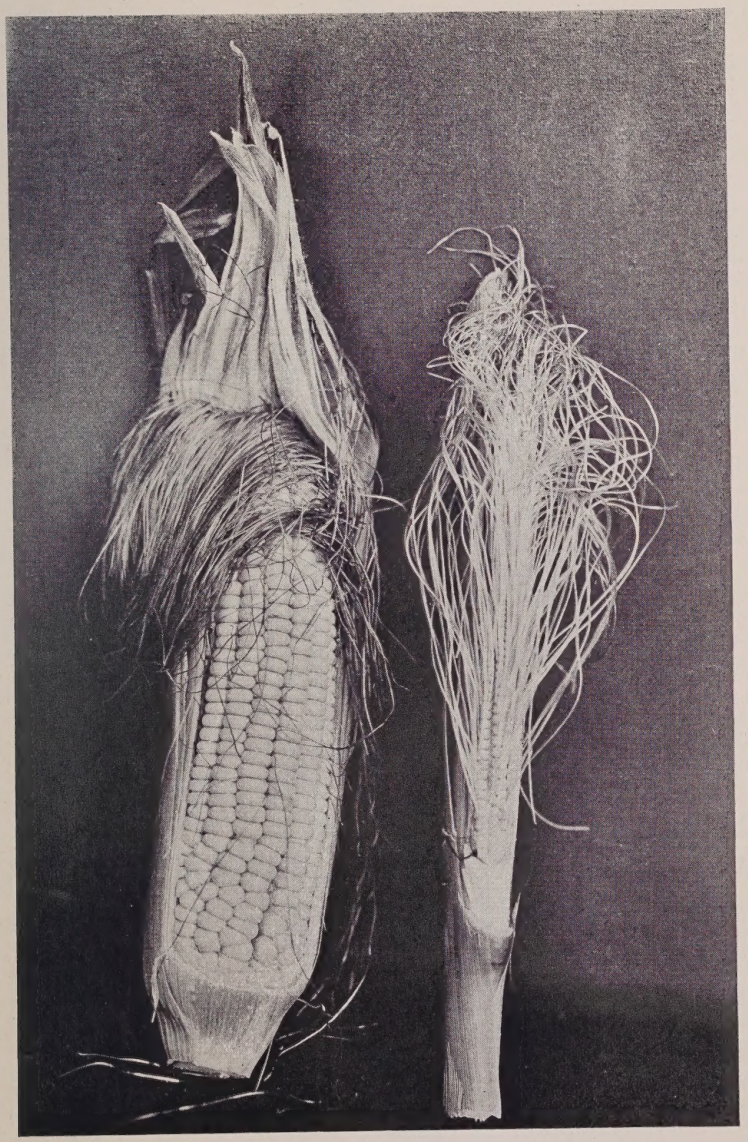


Plate III. Corn before and after pollination.

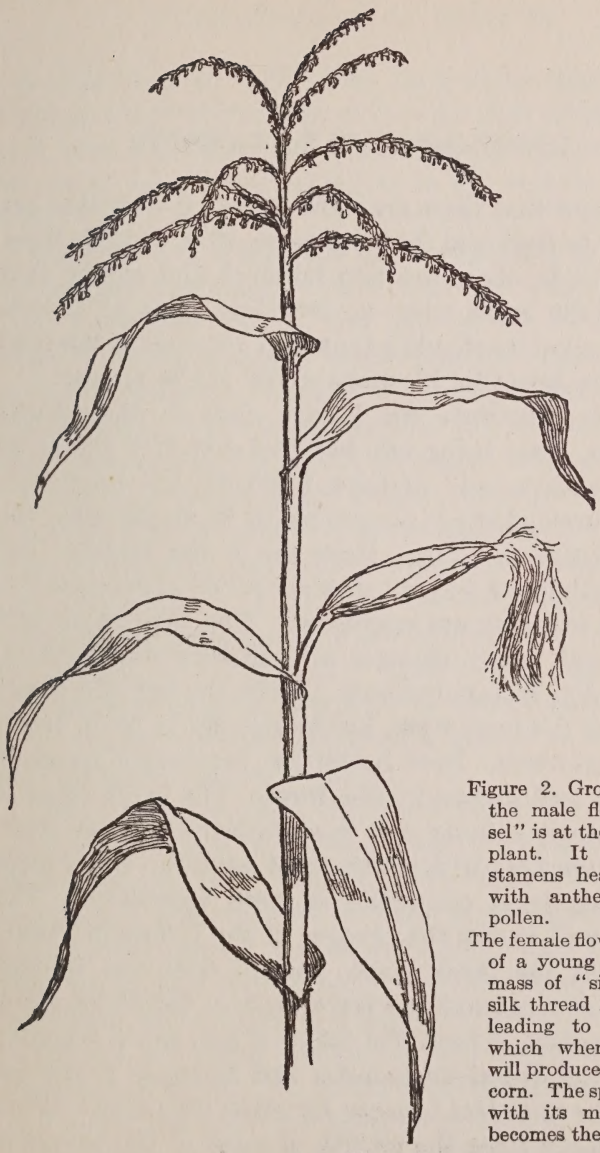


Figure 2. Growing corn; the male flower "tassel" is at the top of the plant. It consists of stamens heavily laden with anthers bearing pollen.

The female flower consists of a young ear with a mass of "silk." Each silk thread is a stigma leading to the ovary which when fertilized will produce a kernel of corn. The spike or axis, with its many ovules becomes the cob or ear.

DEVELOPMENT OF INSECTS

We know that there are thousands of insects that are enemies to fruit and flower at some time in their lives. For example, there are two hundred and eighty that damage the apple crop; nevertheless, were all insects exterminated we should have many crops sadly lessened and many beautiful blossoms would fail to appear.

Insects constitute the largest class in the animal kingdom, there being two hundred and fifty thousand known species, and perhaps 2,000,000 not described. Their development is accomplished in stages after the egg is hatched. True, there are a few insects that bring forth living young; they are called ovoviviparous, but the majority are egg-layers. The eggs hatch and go through many changes or transformations called, technically, metamorphoses. From the egg the insect passes to the *larva* form, known usually as grub, caterpillar and worm. Bees, butterflies, beetles and common flies are well known in this form. The larva stage is one of great activity and is accompanied by an enormous appetite, with consequent growth, the worms devouring great quantities of fresh vegetation. The farmer well knows the ravages of the Colorado Potato Beetle in the larva state, and so does the tobacco raiser know too well the larva state of the Phlegethontius Carolina, a beautiful fellow if you are a scientist, but a frightful green monster and nuisance if you are trying to raise leaf tobacco for cigar wrappers. While in the larva state the growth of most of the worms or

caterpillars is so rapid that their skins become too tight and they then moult or cast the skin, as the snake and newt do. The moulting process is repeated from two to a dozen times according to the various sorts of insect.

When growth is attained the worm ceases to eat and enters the *pupa* state. Some form a chrysalis, with a hard protective surface, and hide in the earth, while other varieties surround themselves with silken nests, as the cocoons that we see on the trees and fences. The insects that made cocoons usually with the warm days of the next spring come forth as winged creatures. The larva state is generally the longest period, even lasting for years in some instances; as for example, the Harvest Flies or Cicadas, which live in the adult, *imago*, state only five weeks. "Four years (seventeen) hard labor under ground, and a month of feasting in the sun; such is the life of the Cigale." Fabre, the author just quoted, had wonderful powers of observation and as great facility in describing what he learned, a writer for all intelligent persons to enjoy.

From the pupa state the insect at the proper time emerges an adult, scientifically termed *imago*, usually with wings, the perfect insect. The writer once had the privilege of observing the eruption of a cicada from its neat brown prison; the cicada nymph had come up from the ground after sixteen years of sucking sap from roots, and was clinging to a large tree trunk. It caught the eye of the writer just as the skin began to split at the top and back. When the rent had extended half way down the back the broad head and shining eyes of the locust protruded. As the opening enlarged the

locust slowly emerged with his moist gossamer wings shining in the sunlight; these by degrees were unfolded and expanded until all wrinkles were obliterated and the marvellously delicate and iridescent aeroplanes were ready for flight. As this seance occurred on a Sunday afternoon it naturally suggested a resurrection and a beautiful one indeed.

A detailed account of one or two of our insect benefactors will illustrate some wonders in development. It will tend to make us forget the ravages of the gypsy moth and weevil. Although insects in the adult or larva state destroy 20 per cent of the fruit crop, we should remember that fruit trees depend largely upon insects for pollination.

As the silk worm has a complete metamorphosis and an interesting history we have chosen it for detailed description. Silk history runs back to the Empress Si-ling in China, who in 2640 B. C. was encouraging the silk industry in her country, which seems to have been the original home of the silk moth and the mulberry tree. Aristotle wrote about silk before Alexander the Great imported it from Persia. It "was imported at Cos where it was woven into a gauzy tissue, the famous Coa vestis, which revealed rather than clothed the form." In those days silk was worth more than its weight in gold. No wonder that Aurelian in an economical mood declined to buy silk for his empress.

The silk worm is the larva of Bombyx mori, a moth whose home was originally in China but which has been introduced with varying success into many parts of the world. The attempts at profitable cultivation in the United States have been unsatisfactory thus far.

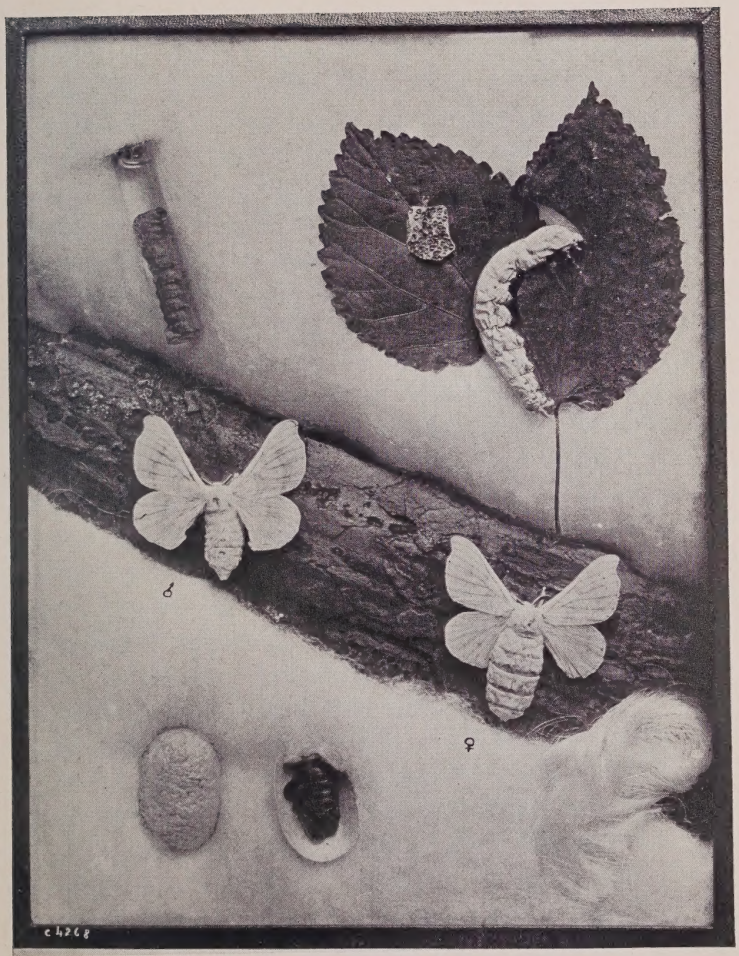


Plate IV. Silk worms in various stages; eggs, larva, young and full grown; cocoon with chrysalis, mature moths male and female; bunch of silk in lower right corner.

The expert entomologist will class the silk moths under Lepidoptera, meaning "scaly-winged." If you look at the dusty surface of a wing under the microscope, you will find the hairs flattened like scales. They are beautiful, as are the hairs and scales of all butterflies and moths. The moths are about an inch long, the male the smaller of the two and with an abdomen terminating in a blunt point. The female, his spouse, is larger and has an abdomen large and rounded, apparently too heavy for her. Each has a dingy white color both of body and wings; the latter are in two pairs lying out flat as is the fashion of moths; not standing up, like the wings of butterflies. Across the wings are pale brown bars, brighter and more distinct in the male than in the female and serving therefore to distinguish the sexes. The eyes are very small, not the large orbs of so many of the day-flying creatures. The antennae, "feelers," are very large, of the feathery variety, and contain thousands of smelling openings or organs, in addition to being very sensitive to touch. The female has very large scent glands that seem to add to her attractions, so that the male with his extraordinary olfactory development has no difficulty in finding his mate even though his vision is limited. If he suffers loss of the antennae he cannot find her. The moths mate almost as soon as they are hatched; if in captivity, the coupling is under the observation of an attendant who promptly throws away the male. The female is placed in a darkened room until she lays her eggs, which number from five hundred to two thousand. These are little bluish spheres about the size of the head of a very small pin, and in nature are deposited

on leaves; they are set singly and stick, but not to each other as they are not massed like the eggs of the gypsy moth. The number of eggs is fairly large, but does not put this moth in the class with the white ant, the greatest egg producer among insects, which lays sixty eggs per minute. The moth eggs weigh one grain to the hundred. The eggs are usually laid in June, but do not hatch until the following spring, for example in April, when there is an abundance of fresh vegetation.

The little worm (larva) is a great feeder and sets to eating as soon as it gets its greyish green body out of the shell; its favorite diet is white mulberry leaves, though it will eat black mulberry, Osage orange leaves or lettuce. When six days old it will have grown so that it must molt, *i. e.*, change its skin; this is done by the cracking at the front and back and allowing the occupant to wriggle out, forcing the discarded skin backwards. The molting process is repeated on the 10th, 15th, and 23d days after hatching. This is a rapid change of coat, more so than in other branches of the animal kingdom. Birds molt usually once a year, toads cast their skins once, fur bearing animals shed their hair once, in the spring, etc. When the larva has grown to three inches in length it stops eating and prepares to construct a cocoon in which it passes into the chrysalis state. Instead of a greenish worm it has become yellowish white. The cocoon is an inch and an eighth long with rounded ends, and if it contain a male there will be a slight depression at the middle belt line. Three instead of seven is the cardinal number for the moth, for the larva is three inches long, it spends three days

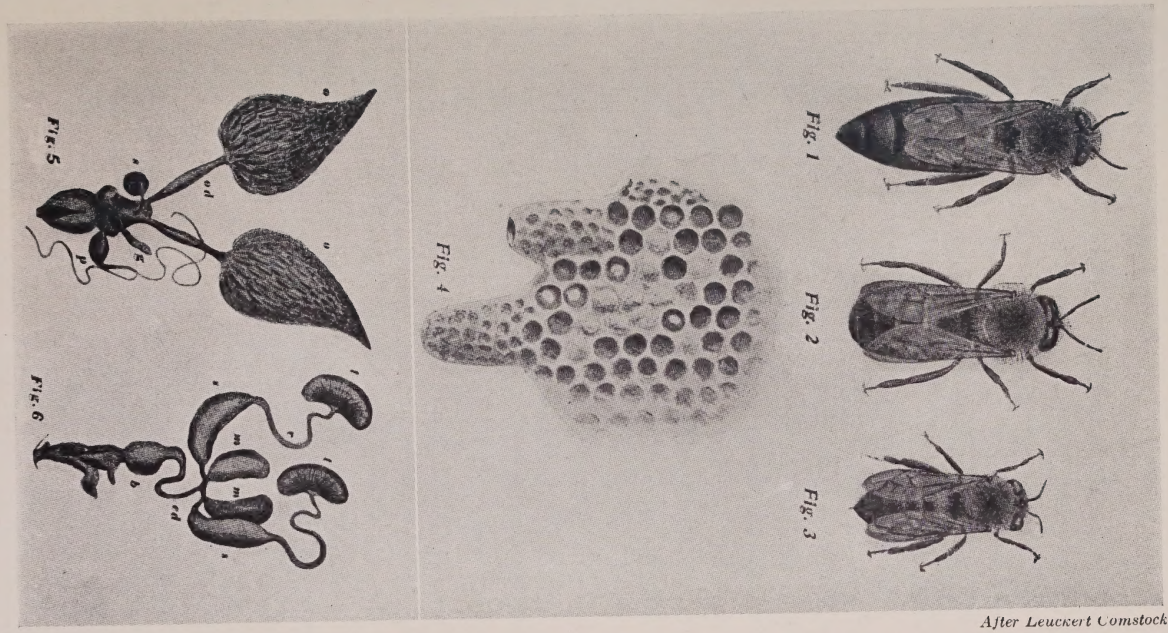
in spinning the cocoon and remains in it three weeks before emerging a perfect adult, *imago*.

The caterpillar is provided with glands to secrete the silk forming substance. These glands extend almost the entire length of the body and develop rapidly as the time approaches for spinning. The viscid substance to form silk passes through two spinnerets in the upper part of the mouth; it will therefore be seen that each thread consists of two filaments. After building the golden shell-like cocoon which is of coarse material, the worm surrounds himself within by the fine silk which is desired by man (or woman). This thread is found to range from three hundred to nine hundred yards in length when reeled for manufacture. After three or four weeks in the chrysalis, the feet, legs and wings form so that the new mature insect is ready for coming forth; however, the silk grower will attend to that and unless he wants to raise the worm for breeding he will give it a hot bath which causes its death. The heat also renders the silk soft, ready for reeling and for manufacture.

The accompanying illustration, Plate IV, shows the stages of silkworm life and at the same time the manner of development of the lepidoptera family. The eggs are shown on the under side of the leaf, a worm three weeks old is in the bottle of formalin, and a fullgrown worm is on the mulberry leaf at the right. On the branch across the middle of the picture may be seen the male moth at the left, and the female moth, the larger one, at the right. Below is the cocoon, cut across to show the interior with the chrysalis three quarters of an inch in length, which a short time before had been

a three inch worm. Nature is an economist at packing. The silk has been removed and is shown in a hank or skein at the lower right corner of the cut. When the moths are allowed to hatch naturally they very soon unite and the female having been impregnated the male presently dies. Not long after laying her eggs the female will also perish, probably like the male without having eaten at all during adult life. The perpetuation of the race having been accomplished they have no further mission. Therefore, to nature's greatest spinner—finis. Insects are very prolific, but very few exhibit any family life or care of the young. Death after fulfilling the reproductive demands is very common. Courting is an interesting performance with many of the insect world, but ends in tragedy, many females even devouring their recent lovers. Fabre, in *Social Life in the Insect World,* describes the assassination of the Golden Scarabaeus as an end to his nuptials, and the brutality of the Praying(?) Mantis who begins to eat her mate ere he has left her embrace. As that author says "insects can hardly be accused of sentimentality." Their code of ethics must differ from that of man, for we would count such acts as examples of total depravity.

The honey bee, Apis mellifera, is another useful insect with a reproductive history of interest to man. See Plate V. Probably no other insect has inspired such an amount of good literature and scientific study. Most people with a taste for good reading are familiar with Maeterlinck's *Life of the Bee.* A few persons will have read Huber's *New Observations on Bees,* new in 1789, and even at this time new to many persons. The



After Leuckert Comstock

Plate V. The Honey Bee (Apis Mellifera). Fig. 1, The Queen; Fig. 2, Drone, male; Fig. 3, worker; Fig. 4, Honey comb with queen cells; Fig. 5, Reproductive organs of queen; *o*, *o*, ovaries; *od*, oviducts; *s*, spermatheca, reservoir for sperms when received; *p*, poison sac and sting. Fig. 6, Reproductive organs of the drone: *t*, *t*, testes; *v*, *v*, vas deferens leading to the seminal sacs; *m*, *m*, mucous glands; *ed*, ejaculatory duct; *b*, bulb or pouch. The bulb and the following parts are everted at the time of pairing. (Courtesy of Doubleday, Page & Co.)

astonishing thing about this book is that it is the work of a man blind from boyhood, who was obliged to use the eyes of another but whose mind made up for the handicap. What an inspiration such a life work should be to us who can see and who ought to think. Bees are the ideal socialists of animal life. Everything is for the good of the community, not the individual.

A bee colony consists of three kinds of inhabitants: a queen, the mother of the new swarm; drones, large clumsy fellows who prospectively are to be fathers to the new swarm, and a multitude of workers who are non-reproductive females that perform all the labor of the hive. The queen is usually alone in her glory, though occasionally more than one will be found in a hive; the drones number three or four hundred until after the massacre to be mentioned later. The workers prepare the comb and bring in the pollen and honey; they feed the young bees and seal them up when the time comes for them to complete the pupa state; they attend the queens, feeding them on royal jelly; they kill the useless drones and drag them forth with other rubbish, because the hive must always be very clean. They make a terrible slaughter of the males by cutting off their wings and often legs also before stinging them to death. The worker bees may number fifty thousand.

If we begin the study of the bee at the egg we find it as a wee speck in the bottom of a cell, but it remains in the egg only three days, then is six days as larva with the cell open so that it may be fed; the workers then seal the cell and confine the grub twelve days longer while the feet and wings develop; after the twenty-four days, the bee cuts his way out with his strong man-

dibles. If the bee is a drone he will spend two or three weeks in roaming about the hive eating his fill of honey that he did not gather, and will then be ready to go forth and meet the queen. The first queen to hatch is by priority the sovereign, and her first object is to hunt up a cell of honey. When satisfied with that meal, she seeks out other queen cells which she breaks into, tearing the cells and biting or stinging her developing rivals. The worker bees complete the work of demolition and promptly clean house again. Boys are in a measure like queen bees. We remember our first summer in the apiary and being told to eat "all the honey we wanted." A surfeit of honey cures one of the desire for that sweet for many months. Bees are often fighters for self-preservation, but are not at all interested in helping injured comrades, they are not awake to the conservation of cripples. A. I. Root says that "they have just the same feeling for their fellows that a locomotive might be expected to have for a man that it had run over."

When the queen is five or six days old she looks out from the hive, and on a warm afternoon will fly a little to try her wings. "Finally she tremblingly spreads those long silky wings, and with a graceful movement that I cannot remember to have seen equalled anywhere in the whole scope of animated nature, she swings from her feet, while her long body sways pendulously as she hovers about the entrance to the hive." (Root). Insects have a highly developed sense of smell, the olfactory organs being in the antennae as mentioned when describing the silk moth. It is estimated that the drones have thirty-seven thousand eight hundred

olfactory (smelling) cavities in each antenna. It must be that this is an aid to the male bee in becoming aware of the presence of the queen. There is also the unusual sound of the queen's wings as she flies. Be that as it may, the fact is that the beautiful virgin is not long out before she is surrounded by the 300 or 400 drones from her own hive, and if there are other hives in the neighborhood she may have several thousand suitors on this her wedding trip. She is sometimes seized by her mate near the ground, though more often there is a wild chase high in the air until a strong and persistent lover clasps the prize with his feet. They holding each other as if in arms are thus free to keep the wings whirling them higher and higher in the sky. While at these dizzy heights the queen is impregnated and the nuptial flight that began auspiciously ends tragically for the male. As he breaks away from her embrace it is with the loss of his special organs, for they break from him as does the sting of a worker bee in your hand.

To quote from Maeterlinck:

> "When the breathless queen has reached the alighting-board, some groups will form and accompany her into the hive; where the sun, hero of every festivity in which the bees take part, is entering with little timid steps, and bathing in azure and shadow the waxen walls and curtains of honey. Nor does the new bride, indeed, show more concern than her people, there being not room for many emotions in her narrow, barbarous, practical brain. She has but one thought, which is to rid herself as quickly as possible of the embarrassing souvenirs her consort has left her, whereby her movements are hampered. She seats herself on the threshold,

and carefully strips off the useless organs, that are borne far away by the workers; for the male has given her all he possessed, and much more than she requires. She retains only in her spermatheca the seminal liquid where millions of germs are floating, which, until her last day, will issue one by one, as the eggs pass by, and in the obscurity of her body accomplish the mysterious union of the male and female element, whence the worker-bees are born. Through a curious inversion, it is she who furnishes the male principle, and the drone who provides the female. Two days after the union she lays her first eggs, and her people immediately surround her with the most particular care. From that moment, possessed of a dual sex, having within her an inexhaustible male, she begins her veritable life; she will never again leave the hive, unless to accompany a swarm; and her fecundity will cease only at the approach of death."

A good queen lays two thousand or three thousand eggs in a day when honey is abundant; if not she knows and lays fewer eggs, for why produce young when there is little fare. Did she ever read Malthus? Moreover she lays drone eggs or worker eggs at will.

The presence of a male is not essential to the laying of eggs in the queen bee any more than in the hen; however as with birds, the fertility and value for another generation depend upon the male and female meeting. One union is enough to insure fertile eggs for many days, possibly for the entire one hundred and twenty that an industrious White Leghorn is expected to lay. The queen bee during her nuptial flight receives possibly twenty-five million sperms, more than enough for her needs although she may live to be four or five years of age. Impregnated eggs are necessary for the develop-

ment of worker bees and queens, but a virgin queen may lay eggs that will grow to be drones only. This brings us to the subject of parthenogenesis, a term longer than the queen bee herself. Par-then-o-gen'-e-sis is Greek for virgin reproduction, that is reproduction without sexual union, much like the budding of the lower forms of life. The little green fly (Aphis) that infests our house plants is produced in that way all summer, though males appear to fertilize the eggs in the latter part of the season. These are the insects called "ants' cows" because they provide a sweet exudate much sought after by the ants. Plate V shows very clearly the three classes of bees in a hive; the queen of majestic mien; the drone useless, but for one purpose; and the worker, "the busy bee," of common speech. The honeycomb figure shows cells nearly filled with honey, also rounded top cells, occupied by growing drones, and two large queen cells appearing like peanuts, at an angle to the other cells.

The figures of the generative organs at first surprise us with the relatively enormous ovaries, having the gross appearance of two strawberries. When we reflect that from those glands may come hundreds of thousands of new beings, we pass from surprise to wonder and admiration.

". . . . So work the honey-bees,
Creatures that by a rule in nature teach
The act of order to a peopled kingdom."
Henry the Fifth, Act I, Scene 2.

PROPAGATION OF FISHES

Moving upward in the evolution of our subject we come to fishes. Boys and men are fond of catching fish, and we suppose they always have been. A few persons add to their sportsmanship a study of the habits of the finny tribe. Anyone who will, may do so if not in the open at least in home or school aquariums.

Nearly all fish construct nests more or less crude as a rule, but in some instances very complicated, in which the female deposits her eggs, the male afterward emitting the sperm cells over the eggs and so fertilizing them. If you have patience you may watch the sunfish scoop a shallow depression in the sand and keep guard over it against all comers while the eggs incubate. The male is the sentinel, and a pugnacious one, darting at any careless fellow who attempts to swim too near the precious nest.

Many boys catch sticklebacks in the spring time to keep in aquariums in order to observe their nest building. The male constructs a long round nest, not unlike a barrel, made of little twigs and grasses glued together. Into this one room apartment he coaxes his mate and they rear a family or at least deposit the eggs. One of the prettiest of nest builders is the Paradise Fish (Macropodus viridi-auratus), Plate VI. Although it is a native of China, it may be had of any aquarium dealer. In June the male takes on very gorgeous colors, purple, blue, golden, bronze, and in some varieties

Plate VI. Paradise Fish. Note the floating nest on the surface of the water.

bright red bands. The rainbow seems to have been robbed to provide the wedding garments, as is common to many fish at the mating season and by no means confined to the paradise fish.

The male builds a nest on the surface of the water by blowing up bubbles of air confined by a glutinous substance that he forms in the mouth. When he has a mass of foam about three inches in diameter he seeks the female and they swim beneath the nest with tail and fins distended to the utmost and there embrace like two crescents. As the fish press against each other the eggs are exuded from the female and the sperm cells from the male, so that a dozen or more eggs are fertilized at each embrace, after which these float up and adhere to the nest. Should they not rise fast enough the father seizes them in his mouth and puffs them up to the surface. When eighty to a hundred eggs have been fertilized the process is stopped. The female then retires, pale in color and plainly wearied by her labor. The male gives his entire attention to the nest, watching it anxiously and catching in his mouth any eggs that drop out and are in danger of falling in deep water. In thirty-six to forty-eight hours all of the eggs will be hatched and appear as wiggling specks with tails barely perceptible. We have had them born in twenty-four hours when in a tank placed out of doors in midsummer. The father is so faithful to his little offspring that he does not stop for four or five days, even to eat, but watches constantly to catch up any falling child and prevent it from getting where the water pressure would be too great. Although some males allow the female to pick up a few falling

fry and return them to the nest, as a rule the male is ugly to his mate and drives her fiercely into a corner from which she keeps an eye on him. After a few days the fry (young fish) are left to shift for themselves, and are no more regarded by the parents, unless the latter are hungry when they will eat them without hesitation.

By far the greater number of fish deposit eggs, yet there are a few that give birth to living young, that are viviparous. Among large fish thus born are members of the shark family. Other sharks deposit eggs that are in strong fibrous cases often found on the sea shore, looking like cheap purses with threads attached.

The illustration, Plate VII, on the opposite page shows two varieties of small fish that are often bred in home aquariums. The light colored pair upon the left are Xiphophorus Helleri, commonly termed Helleri or sword-tailed minnows. The male is very brilliant with a broad band of red, blue and orange extending from his nose to and upon his long sword-like tail. They have several broods of a dozen or more each during the warm summer months. The pair shown upon the right of the picture are Gambusia Holbrooki, easily kept although not easily bred. The Holbrooki show clearly sex differences in color and in shape to such a degree that the uninitiated would not recognize the male and female as of the same species. The female has marked curves of the back and belly with a large black spot on the side of the abdomen giving the appearance of a tear in her waist band. The male lacks the curved and globular form, is long and straight like a little pickerel. In color the black blotches are so abundant as almost to obscure the faintly yellowish skin otherwise showing.

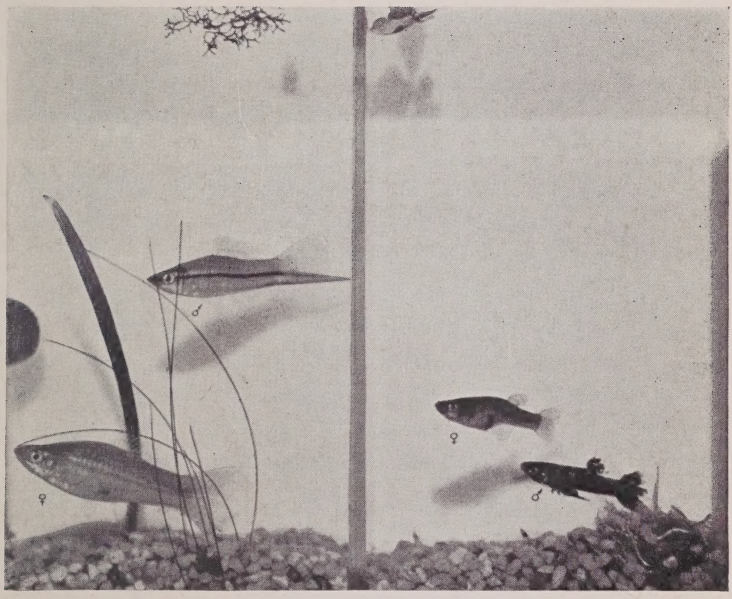


Plate VII. This picture illustrates the difference in form and color between male ♂ and female ♀ of the same species. The fish at the left are Mexican sword minnows commonly called Xiphophorus helleri; the fish at the right are Gambusia holbrooki or Top Minnows.

The fins and tail are so delicate in hue and structure that it requires close observation to make sure that the irregular margins of black color are not ragged edges of the fins. When he is at rest and the observer's vision is keen the true outline may be seen. What appears below like a center-board to a boat is a fin and the intromittent organ. At the breeding time this black beauty sails up to his mate and waves the organ at her from the side or even forward just beneath his chin and for an instant is in contact with her so that fertilization is effected. The gambusia has young once in four weeks in summer time, the number varying from one dozen to four dozen. The reason so few come to maturity in captivity is that the parents are little cannibals and devour the young almost as soon as they are born. They must be born amidst abundant fine plants to afford hiding places from their parents. Other aquarium pets having curious habits of reproduction are the sea horse, the male of which carries the young in a pouch similar to that of a kangaroo; also the mouth-breeders of Egypt (Haplochromis strigigena) and of South Africa (Tilapia nataleusis). The latter make a simple nest in the sand, but do not allow the eggs to remain long after being fertilized, as the mother fish gathers them into the brood pouch in her mouth, where she will keep them about fifteen days until they hatch.

During this period of incubation the fish does not eat and she therefore looks dilapidated when the process is finished. The blind cave fish (Amblyopsis) also has gill brood pouches.

Possibly some of our readers wish we might use food

fishes rather than pets to illustrate our subject. When you have shad roe for a spring luncheon, consider therefore that it consists of hundreds of thousands of eggs; for you know the fish are in season and caught while on their way up the rivers for purposes of spawning. Another fish egg delicacy is caviar, prepared from the eggs of the sturgeon, now nearly extinct. Shakespeare recognized its rarity in the allusion in Hamlet "'twas caviar to the General."

One of the most notable fish of our day is the salmon; though at home in the deep sea these know instinctively that they should spawn in shallow running water. To effect this they start in the spring to make their way up rivers until the depth and temperature suit them, the latter 54°. They swim up the Columbia river for a thousand miles, and have been found up the Yukon more than two thousand miles from the sea. The trip has required four months' time, the overcoming of rapids and the jumping of falls as high as eight feet.

Although the history of Yukon salmon is of comparatively recent date, the salmon is on record and its habits known in history. Our old friend Izaak Walton, in his account of the salmon in Wales, quotes Michael Drayton the poet-laureate of his time (1626) and whom he calls an honest man as well:

"And when the salmon seeks a fresher stream to find;
(Which from the sea comes, yearly, by his kind)
As he towards season grows: and stems the watry tract
Where *Tivy*, falling down, makes a high cataract,
Forc'd by the rising rocks that there her course oppose,
As tho' within her bounds they meant her to enclose;

Here when the laboring fish does at the foot arrive
And finds that by his strength he does but vainly strive;
His tail takes in his mouth, and, bending like a bow
That's to full compass drawn, aloft himself doth throw,
Then springing at his height, as doth a little wand
That bended end to end, and started from man's hand,
Far off itself doth cast; so does the salmon vault:
And if, at first, he fail, his second somersault
He instantly essays, and, from his nimble ring
Still yerking, never leaves until himself he fling
Above the opposing stream."

Here again we encounter one of nature's tragedies; after spawning, either because their mission is ended or because they are so beaten and wounded in the exertions of overcoming gravity, falls, and rapids, the salmon, both male and female, float down stream tail first with the current, and within a few days many die. Salmon have been marked and found to ascend the same river on succeeding years so that it is claimed that some of them live ten years or more.

As an egg-layer probably the blue ribbon of superiority belongs to the cod fish, for she deposits nine millions to fifteen millions of eggs in a season, the greatest fertility known to the writer.

BREEDING OF BIRDS

Having considered sex characteristics in the realm of entomology and of piscatology we now rise to the field of ornithology. Here we shall be sure of attention as every one, old or young, is fond of birds, whose plumage attracts the eye and whose song delights the ear.

Birds are vertebrates that always are distinctly male or female and that lay eggs that are incubated outside of the body. The feathered folks perform many attractive manoeuvres in courtship, Plate VIII and show remarkable and curious designs in nest building. If we note the habits of the birds in our parks and along the countryside, we find that most of them pair only after considerable ceremony, and that the two then set about selecting a proper place for the nest which they together construct. We then observe that the nest is not a permanent domicile for the family, but rather a place in which merely to incubate the eggs and then to rear the birdlings. It is not for personal comfort, but for the protection of the offspring. The choice of a location free from danger will depend largely upon the character of the birds. For example, the humming bird will make a firm little nest, just large enough to hold a silver half dollar, saddled on a tree limb, and cover it so nicely with lichens that it seems to be only a knot of the tree. The eagle, on the other hand, has no need to try to

mislead the eye, to camouflage; she gathers a few sticks and places her eyry with its two or four eggs on a high cliff or in the top of a tall forest tree, and trusts to the strength of herself and her mate to keep off all intruders.

Many birds build among the grasses and tussocks close to the ground, where the nest is hard to find because of color; others build in full sight, but quite out of reach, as the Baltimore oriole, who suspends her nest from the end of a limb of an elm tree. The oriole is entirely outdone by her cousin the Crested Cassique or Yellow tail of South America, for this bird weaves a baglike nest that hangs from three to five feet below the supporting limb. These large birds also illustrate the community feeling that some birds have. It is not uncommon to see a hundred of their nests hanging from the same tree, all safe from intruders because of the noisy crowd. There are many birds that enjoy community living; swallows and doves come readily to mind as of this class, then there are the Republican Grosbeaks of Africa which construct their nests close together under a great thatch like a vast umbrella or mushroom. In this instance "republican" surely does not refer to politics. Our barn and bank swallows dwell in communities without any evidence of families getting mixed. Many water fowls breed in large communities, and not infrequently several species occupy the same incubating grounds.

Mating of Birds.—The courtship and manners of birds in the mating season may be observed in town or country. For instance, the house sparrow is always in town and in spring time makes a noisy ado about his domestic plans. Four or five cocks will address one

little hen and, with wings outspread, in strident voices will declare their readiness to wed. The little hen makes her selection by exclusion based on considerations that we do not understand. On two occasions we have seen a hen take a male by the nape of the neck and shake him off from a limb; in one case, the offender was in suspension for a considerable time before being dropped out from the competition. A selection is finally made, and then the rejected suitors leave the pair to start their new home, perhaps in the vine at the back of the house. Sparrows form a boisterous community.

Doves dwell in social groups, but they have more pleasing ways than have the "pests," the "street Arabs," just described. Doves are more loving and dignified, the male ruffing up his neck feathers and cooing softly his desires while bowing before his would-be mate. All is peace and harmony in the dove cote. Two white eggs are laid in a very simple nest made of twigs, grass, etc., on a beam in the barn, or upon the floor of a box. Both birds take part in incubating, and according to John Burroughs the male goes on duty regularly at noon. In sixteen days there will be two young birds, usually called squabs, though the word squab applies to any young bird.

The ways of the fowls in the poultry yard are well known. They do not pair as do most of the feathered folks, but are polygamous, have more than one mate. The rooster is ready to serve, "treading," any hen that needs him, and having given her his share of the egg, the germ cell, he will depart, proud but unconcerned, alert to run with other hens or fight any cock of the

walk that he may chance to meet. The hen lays an egg each day or second day, and when she has twelve to twenty she will begin incubation, will "set" on the eggs. The temperature of birds is higher than ours, that of the hen being 104°. A temperature of at least 102° must be maintained to insure hatching of the eggs. Three weeks of this constant warmth changes the egg into a chick that picks its way out of the shell but is very willing to be under the mother's wing for some weeks afterward.

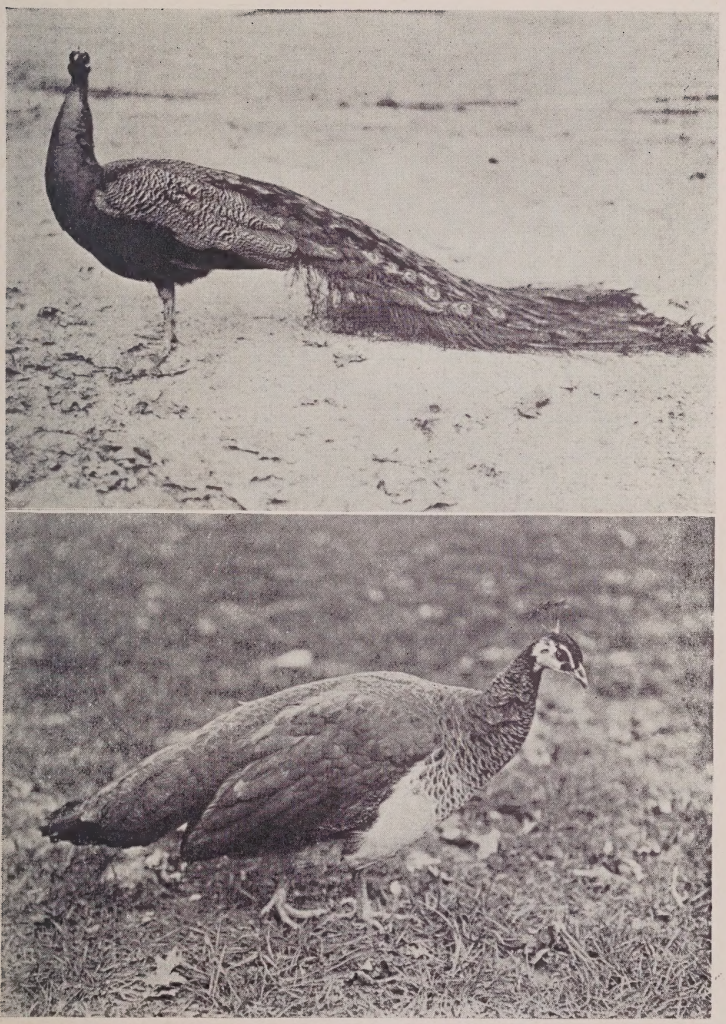
Some of my readers have doubtless visited an ostrich farm and been told of the marital habits of these great birds. They mate for life instead of for a season, and the male bird assists with the incubation if he does not take entire charge, especially at night when the hot sun has disappeared. Incubation requires six or seven weeks of patient waiting and watching of the dozen eggs, though now-a-days many are incubated artificially. On some farms one male bird is confined with several females in which case he is not expected to assist in the incubation.

The sex characters of male and female birds are usually plainly seen; for example, the male is usually arrayed in most brilliant colors, often having feathers in form and hue entirely different from those of his mate. Beginning in the poultry yard we see the cocks with long and resplendent tails, with spurs for combat, with conspicuous comb and wattles and a general bearing of "cock of the walk." The tail development is conspicuously beautiful in the peacock (Plate IX who spreads his gorgeous plumes for the admiration of the hen and possibly with a consciousness that men

admire him also. His bearing is at all times proud and lordly. The egrets, so prized by the ladies, are sex adornments of the male white heron, and are found in perfection only at the breeding season. (Killing these beautiful birds should be regarded as a crime.) Among our common birds there are many examples of distinction in the color of male and female. The blue grosbeak is a case in point, the male being entirely blue except brown tips to the wing feathers, while the female is entirely brown except where there are blue bands on the wings. The scarlet tanager is a common summer resident with jet-black wings and tail, while his mate is not scarlet at all, but of a greenish yellow color.

Of game birds, pheasants and wild turkeys illustrate well the differences of both form and color of plumage in the sexes. The extra crest on the head of the pheasant marks the male only. His reds, blues and purples are all absent from the hen. The female is very plainly attired.

Among the Gallinaceae (domestic fowls) the male is always larger than the female, while among the Raptores (birds of prey) the female is the larger. Perhaps this fact explains the expression, "she rules the roast." A few birds are provided with most unusual appendages; for example, the frigate bird or man-of-war, which has a large purple pouch like a child's balloon under his bill, or the Prairie Hen of our western plains. The male of the latter has two air sacs at either side of the neck, which he can inflate with air until they resemble two large lemons. In the breeding season he is fond of displaying these adornments and also his ability as a fighter. See Plate VIII.



Courtesy Zoological Society. Photograph Elwin B. Sanborn

Plate IX. Indian Peacock and Hen. The peacock on dress parade with tail spread four feet high, is a most magnificent bird.

The accompanying illustration of the courting of the prairie hen was courteously supplied by the American Museum of Natural History, and below we present a description of them as given by permission of Mr. Frank M. Chapman, the bird expert:

"On frosty spring mornings, as the sun rises over the prairies, one may at times hear a singular, resonant, booming note, boom-ah-b-o-o-m, boom-ah-b-o-o-m. It is the love song of the Prairie Hen. He may be near at hand or possibly two miles away, so far does this sound, unobstructed by tree or hill, carry in the clear air. It is well worth following, however, for we may find the maker of it, with perhaps ten to fifty of his kind, engaged in a most remarkable performance.

During the mating season, from March until early in May, the Prairie Hens of a certain district or area gather before day-break to take part in these courtship demonstrations. The feather-tufts on either side of the neck are erected like horns, the tail raised and spread, the wings drooped, when the bird first rushes forward a few steps, pauses, inflates its orange-like air sacks, and, with a violent, jerking, muscular effort, produces the startling boom, which we may have heard when two miles distant.

At other times, with a low cackle, he springs suddenly into the air, as though quite unable to control himself, and finally he comes within striking distance of a rival who has been giving a similar exhibition. Then, with much clashing of wings, a fight ensues which often strews the nearby grass with feathers.

These tournaments of display and combat are doubtless designed to arouse the attention of the females, but they also occur when only males are present. Within an

hour or two after sunrise, the time varying with the ardor of the birds, the competition is over for the day and the rivals feed peacefully together, until they enter the lists the following morning." (From *Guide Leaflet* No. 28, American Museum of Natural History.)

Elsewhere the author tells us that should a hawk fly over, these grotesque cavaliers instantly cease fighting and shrink into little brown masses to escape being seen.

The courting performances of the Secretary Bird are really dances, a mixture of stately moves and foolish hops quite as grotesque as, and more interesting than, many of the modern society dances. The secretary bird is an interesting fellow to watch whether he is killing a snake for his luncheon or exercising his dramatic skill in a hornpipe. The females look on with evident interest if not emotion.

It is worthy of note that birds win the females chiefly by display, while among mammals the males battle for supremacy and leadership of a herd or single female. When we come to man it would seem that the woman wins, often by her display of charms of form, manner or of mind. We would like to believe that the choice is always made more upon character study than physical attributes.

Sexual selection among the birds is very little dependent upon plumage, because the sexes are more apt to be plainly dressed and very much alike. Their "songs were framed fit to allure" not alone their mates, but man likewise. A great amount of the music of nature has sex as an underlying cause, for instance:

"The feathered songster, *chanticleer*,
Hath wound his bugle-horn;
And tells the early villager
The coming of the morn."
Chatterton, *Bristowe Tragedie.*

Among the water birds there is none more dignified and majestic than the swan. As the time for reproduction approaches this bird flies to the Arctic regions or to Hudson's Bay and there builds a mound eighteen inches high of coarse vegetation covered in the top with softer moss. Upon this the female lays her half dozen eggs and while she calmly views the prospect across boundless acres of marsh and sea patiently waits for the cygnets to come forth. The male stands by, adding pomp to the beauty and grace of his consort. The tame swan is the personification of aquatic ease and luxury, but, as this bird rarely breeds in captivity, we are fortunate if we see her with her little ones.

Perhaps the most curious bird home is that of the African Horn-bill. Owing to the fondness of snakes for young birds, squabs, this homely bird selects a hollow tree for a nest; and when the female has ensconced herself within, the male plasters up the opening with mud, thereby imprisoning his mate for the period of incubation. As the young are without feathers when born they for a long time, need protection. The male constantly brings food to his family, and the mother bird takes it in through the window left for the purpose. After two months of confinement she comes forth fat and hearty while her spouse retires thin from over work.

The hanging nests of the weaver birds (Ploceus) are not unlike those of our oriole, but the remarkable

feature is a second domicile built by the male for himself. This is very like an old-fashioned bee-hive open at the bottom and is usually not far from the nest of the female. Here the weaver bird sits on his woven perch and sings to his mate, protected meanwhile from the hot sun or possible storm by the roof over his head. (Richard Owen.)

Letting these examples suffice as illustrative of the subject of nidification (nest-making) we will pass to the organs that produce the eggs.

Reproductive Organs of the Fowl.—The ovaries of the hen are small granular bodies lying close to the back bone. They are alike at the beginning of life, but the left soon takes on active growth while the right remains stationary or actually disappears. Figure 3, B, shows the ova (eggs), in various stages of enlargement due to accumulation of yolk, *a. b.*, which are each held from escape in a capsule called the calyx from its likeness to the calyx of a flower. This capsule is known as vitelline membrane, *i. e.*, yolk membrane, which soon bursts under the pressure of the growing egg, when the latter falls into the funnel (infundibulum) *c.* when the egg has escaped, the calyx collapses, *d.* The infundibulum is the part of the oviduct that corresponds to the fallopian tube in woman. The ovum makes its way along two or three turns of the duct until it reaches the part called the uterus, *i*, where the shell is formed. The next portion of duct is called the vagina, *l*, from which the ovum or egg passes directly into the cloaca, in birds the common outlet of bladder and bowels.

The male organs of the cock are shown in Fig. 3, A.

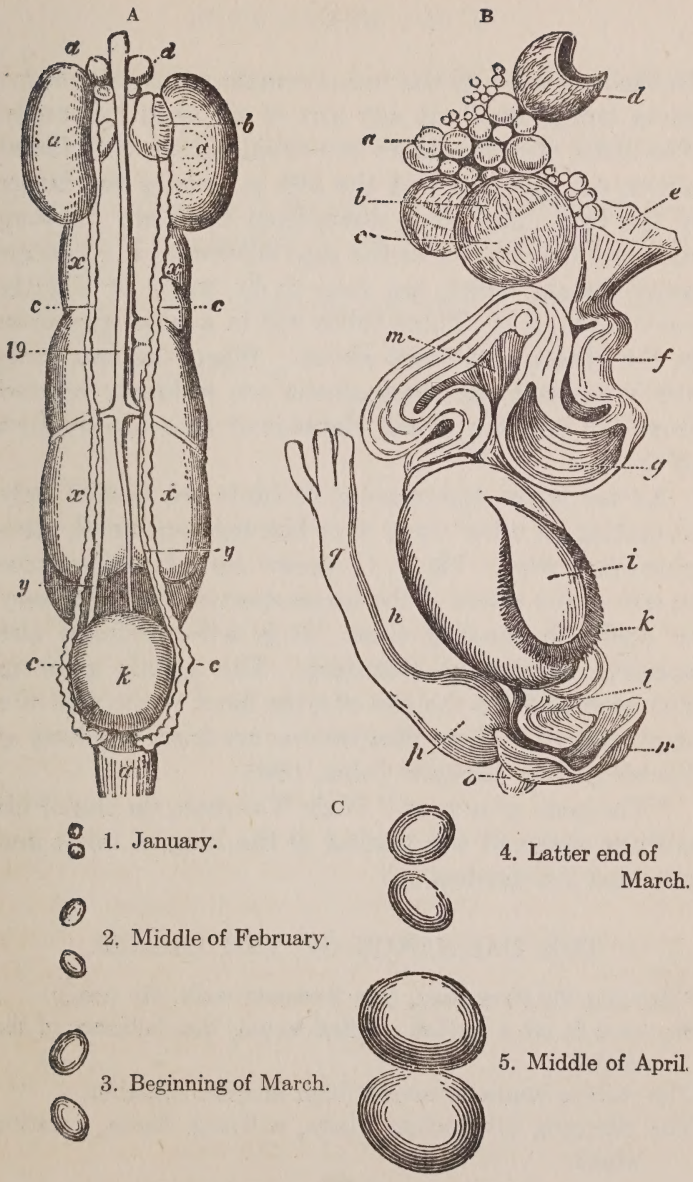


Figure 3. Reproductive organs of birds.

In the case of birds the testes remain within the body, never being outside in any sort of sac as in mammals. The testes of the cock are two ovoid glands, *a.a.*, found above the kidneys, and the left is usually the larger of the two. Extending down from them are the long narrow tubes known as the *vasa deferentia*, *i. e.*, carry-away-vessels, which are seen to be wavy or slightly convoluted, *c. c.* These tubes end in a small elevation in the cloaca mentioned above. When the two birds are in contact the spermatazoa are suddenly ejected from the papillae (small elevations) into the oviduct of the hen.

As the testes (spermaries) of birds are needed only at mating, at other times they become very small, atrophied as it were. Fig. 3, C, shows the relative increase in size of the testes of the house-sparrow from January to April, the nesting time. It is self-explaining and requires no further comment. The glands grow in four months from the size of a pin head to the size of a small cherry. These illustrations are from *Anatomy of Vertebrates*, by Richard Owen, 1866.

"The good grey poet," Walt Whitman, on one of his outings observed the mating of the king of birds and recorded the incident in

THE DALLIANCE OF THE EAGLES.

"Skirting the river road, (my forenoon walk, my rest,)
Skyward in air a sudden muffled sound, the dalliance of the eagles.
The rushing amorous contact high in space together,
The clinching interlocking claws, a living, fierce, gyrating wheel,

Four beating wings, two beaks, a swirling mass tight grappling,
In tumbling turning clustering loops, straight downward falling,
Till o'er the river pois'd, the twain yet one, a moment's lull,
A motionless still balance in the air, then parting, talons loosing,
Upward again on slow-firm pinions slanting, their separate diverse flight,
She hers, he his, pursuing."

ANIMAL COURTSHIP

The poet says that all the world loves a lover. The lover of nature cannot but be interested in the love play or demonstrations of those in feathers and furs and the finny folks. While a few of us can watch the wild animals in their native haunts, others can observe them in the zoological parks of our cities. The peacock and pheasant make a great display of tail feathers, to attract the hens, the peacock with great dignity and decorum, the pheasant dashing before the hens with ardor and speed and showing resplendent tail feathers spread as if on edge. They make a finer show indeed than the ladies who later parade in the same plumes.

Fighting is not confined to bulls with or without registered pedigree, but is characteristic of wild life in general. The stag and buffalo are ever ready to lock horns with an adversary. The deep voice of the moose in wild country sends echoes for miles around. The victor in these battles becomes the leader of the herd of females and the father of their young. The bellowing of the bull at the farmyard and the neighing of the stallion in his stall are announcements that they are here for a purpose.

Returning again to indoor study we find that the aquarium affords an opportunity to watch the love making of fishes, newts, etc. The male newt or water lizard (Diemictylus viridescens), fanning the female with his broad tail before they proceed to spawn,

engages our attention. He is the monkey of the home tank.

Most of the music of the fields is produced by male animals, birds or insects, the female answering but a little. The earliest sex calls that we hear in the spring are those of the frogs and peepers. In midsummer we have the sharp ceaseless song of the Cicada, the seventeen-year locust, "that obstinate melomaniac" as Fabre calls him. (Read *Social Life in the Insect World,* by Fabre.) The Katydid (Platyphyllum concavum) continues his loud and shrill music until late in the autumn. We should not leave the insect world without mentioning the fire-flies, whose love signals instead of cries, are flashlights, said to be one hundred per cent efficient. The electric arc light is only ten per cent efficient.

The dominating instinct of the lower forms of life is that for continuing the race, and the provision for safety of eggs and of young is in many cases unique and marvelous. Parental care does not seem to exist with all animals, although there are many that, even of low intelligence, show solicitude for their young equal to that of the human mother. Crabs, which the boys love to catch, may be found with their young attached to them. Some spiders and frogs also carry their little ones "bare back." Seafaring folk often meet with the violet snail of the tropical seas (Ianthina). This little sailor is steadied by a raft-like appendage on the underside of which she fastens her eggs; although she moves about freely the family is always at home and together.

The Argonaut, the paper nautilus, is another beautiful creature with interesting structure and habits of

breeding. One of the long tentacles is the sex organ, the heclocotylus arm, that bears the sperm cells. In at least three of the varieties of nautilus the sperm bearing arm, when attached to the mantle of the female, remains there. The other feature to note is the ingenious little shell boat in which the mother sustains her eggs and young.

"They are blent with all the glory
of all the sea;
One with the golden West."

Alfred Noyes.

Nature study, by the way, is not so new as some persons are inclined to think, for Aristotle knew about the nautilus twenty-two hundred years ago. Had he not been an observer he could not have written his ten books on Natural History, as well as those on philosophy. We can imagine him instructing young Alexander as they walked in the gardens. That is the proper way to learn to this day, the parent or teacher stimulating the youth to observation and to reasoning.

Sex behavior is worthy of notice in many wild animals as well as those domesticated. Deer always command attention and are deserving of it. The male, the stag, is a noble creature with a clear beautiful eye, into the very depths of which you can look. He keeps ever on the alert to apprise the herd of danger. Although a peace loving animal by nature, he will lunge savagely with his antlers, lock them with another stag and fight to the death. The female, the doe, is not provided with horns nor is the fawn, the young of the deer.

Courtesy Zoological Society. Photograph Elwin R. Sanborn

Plate X. Red Deer family: The stag (male); doe (female); fawn (young).

Plate No. X is a pleasing picture of a deer family, father, mother and baby. In the wild state the stag or buck shows a sense of responsibility and chivalry for he generally keeps awake while the does take their rest in midday, and as they drink at the lakeside he watches until they have had their fill. Grace and nobility are outstanding traits of the deer. Our school children and youth would do well to observe them whenever possible. Some of our older readers may recall the painting of "Deer Drinking" by Rosa Bonheur. It represents a spring morning about sunrise. The group of deer are just stepping into a pool to drink. The male is on guard. He looks us in the eye with a questioning expression and although his horns are merely in the velvet, not mature nor hard, he seems ready to attack on slight provocation.

MULTIPLYING OF MAMMALS

We rise now to the highest class of animals, the division of vertebrates called mammalia. Mammalis signifies of the breast, and the term designates that all the animals belonging to this class nourish their young on milk furnished by the mother. Moreover the young are developed within the body of the mother instead of being incubated as are the eggs of birds. Mammals nurse their young at the breast from a nipple or teat, the milk gland being known as udder in the cow, dug in the deer and as breast or bosom in the human family. The mammary glands number from two to a dozen according to the number of young that may need to be suckled at once, one or twins in man, but perhaps eight or ten little pigs. See Plate XI.

While within the mother, the embryo or young are nourished by blood circulating through an organ called the placenta that is attached to the inside of the uterus and connecting the latter to the embryo by the umbilical cord. In this way nourishment is freely carried from the mother to the developing young.

Mammals are usually provided with four limbs but these are frequently modified in various ways. For example, bats have practical wings, and whales have their hind legs so undeveloped as to be scarcely perceptible; yet these are members of the same great family with man and most of the domestic animals. Other characteristics that mark the class are the chain

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Plate XI. Sow suckling her litter. Self-service lunch.

of little bones in the ear, the direct hinging of the jaw bone, the existence of hair and horn, etc.; but as these matters do not pertain to reproduction we let mention, without elaboration, suffice. The mammals all have more or less elaborate brain development and hence show degrees and sorts of intelligence that are to be taken into account when considering sex characters other than anatomical.

The sex organs are the chief distinctive features between male and female, but there are numerous secondary characters, as the antlers of the stag, the heavy fur and horns of the bull Bison, the heavy mane of the male lion, the massive neck of the male horse, the stallion. Among cattle the thick neck and heavy horns are attributes of the bull only. In the sheepfold the males, rams, are usually endowed with thick horns that are often curved to a spiral. Among the family pets, as cats, dogs, rabbits, monkeys and marmosets, there are no special secondary sex marks.

MAN

Having given attention to the birds of the air, the beasts of the field, and fish of the sea, we come now to Man the supreme mammal, as one has said, "*the* psychic organism of the known universe."

Development is progressive in all nature, which of course includes man. A complete and comprehensive study of man as to his body, his mind and its workings, his customs and habits, constitutes the science of anthropology. This is again divided into other sciences; as, his physical characters—anthropometry, race divisions—ethnology, geographical distribution—ethnography, relations to fellow men—sociology. The study of man's bodily structure comes under the head of morphology. The *ology* or the branch of knowledge that will engage us chiefly, will be embryology, the development of the egg through the stages involved before birth. The details of this subject will be followed in a succeeding chapter.

Man differs from other vertebrates in many ways, the most noticeable being the straight lines of the face, the great size of his brain, the relatively wide pelvis, the fact that he stands erect, and the unusual skill and nimbleness with which he can use his hands.

Man has been divided into races by a simple color scheme and each family has developed or is progressing under varying influences of climate, environment, education and social improvement. As we shall refer

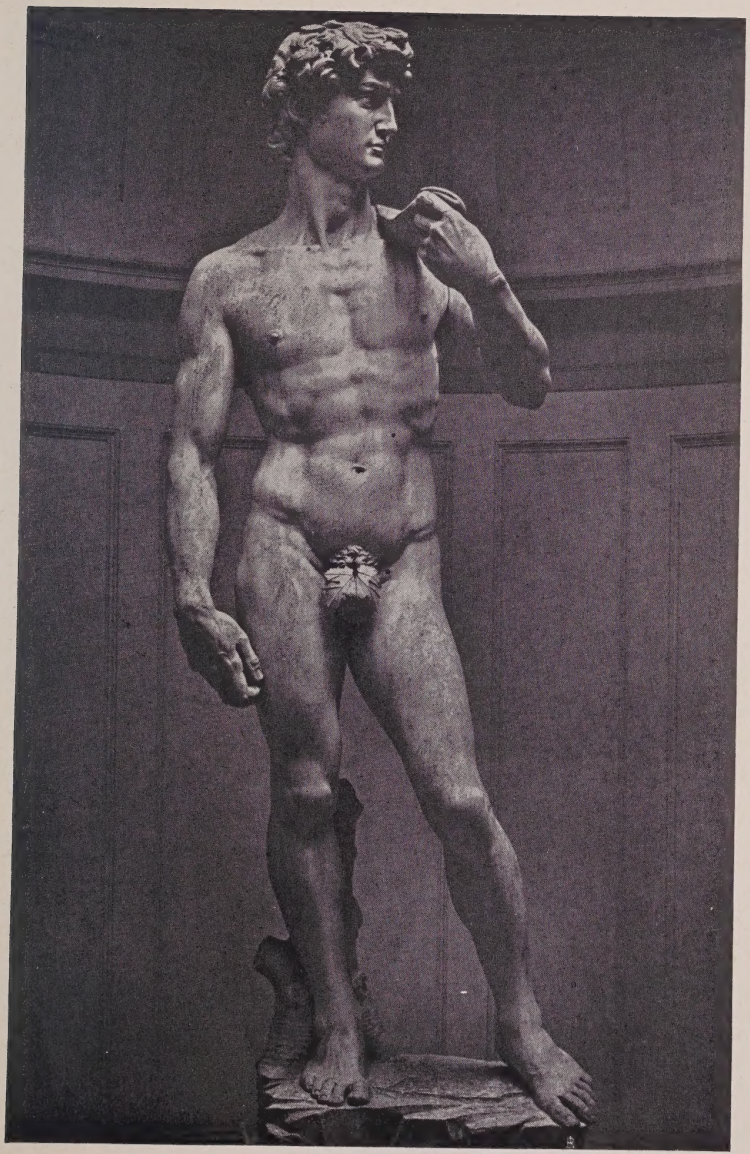

Plate XII. David.
By Michaelangelo. A. D. 1504.

to the habits of many peoples in many lands when studying family customs it may be well to list the races. According to the ethnologist these are first, the White or Caucasian (Europeans), then the Yellow or Mongolian (Chinese), the Brown or Malay (Phillipinos), the Red or American (American Indian) and the Black or African (Negro). Whatever the country whence they come and whatever the race to which they belong "a man's a man for a' that" and has the same loves and hates; they all arrive on this planet involuntarily and usually leave against their will.

Standards of form and of beauty for male and for female are not the same in all countries. We shall give most attention to our own kind, the Caucasian. In art we find an example of youthful vigor and becoming dignity in the statue of "David" by Michaelangelo. This artist, architect and sculptor had consummate ability to see and portray human anatomy in all attitudes. The "David" (see plate XII) was erected in Florence in 1504 to commemorate the deliverance of the city from the Medici and Caesar Borgia. The sculptor shows a young man with all the muscles clearly defined on limbs that are strong, and with a deep chest and sturdy trunk.

The face indicates determination and expectation of victory. The sculptor could not indicate the ruddy countenance of the shepherd lad; the point to be borne in mind is, that youth is ruddy and ready and optimistic.

Man must contend with nature, therefore each set of muscles is well developed without excess of fat that might impede their action. The male shoulders are

broad as becomes the burden bearer, while the pelvis is narrower and stronger than that of woman. The hands of man are long and the fingers strong, more as would be expected of the bread winner.

Man's "vast chest is for breathing, and for eloquence and command. From its capacious stores of oxygen he draws the elements of the most strenuous, the most protracted, exertion. He breathes deep, that he may ascend the highest hills and the sharpest crags in pursuit of his game or his prey, and that his loud harmonious voice may command his armies in the midst of the conflict—or sway the forum with its tones. Like Virgil's wild horse—he is equal to the longest career—nothing can stay him in his race.

> "See his loins how they are narrowed down, as they approach the hips, that he may balance himself, as it were, on the point of an inverted cone, ready for the promptest motion. His pelvis contains no variable organs requiring ample space for extraordinary developments; but its depth and solidity afford origin and insertion to the powerful muscles by whose immense strength he can act well in the wild, rude, adventurous life to which he is ordained."—*From Meig's description of Apollo of the Belvedere.*

Normal Measurements.—While we are pleased to present the "David" as an artistic model, we know that some young man will not be satisfied with the human form of four hundred years ago if that of the present day is better. In order to arrive at a modern physical ideal, the Society of Directors of Physical Education in Colleges, in 1902, took an average of fifty of the men who gave the best all round strength

tests in the previous eight years. Dr. Sargeant provided the measurements based upon examinations of 400 men at Harvard University. From these figures was modelled the statue giving the proportions of the typical college athlete.

Man, Age, 22 Years

Height.....5 feet 9 inches
Weight.....159 pounds
Expanded chest.....40 inches
Waist.....10 inches less
Neck, knee and calf.....Of equal girth
Upper arm.....1½ inches less
Girth of thigh.....½ inch less than head
Girth of hips.....Almost the same as the unexpanded chest, while the breadth of his waist barely exceeds the length of his foot, and the stretch of his arms measures 2 inches more than his height

See R. Tait McKenzie, "Exercise in Education and Medicine," 1915.

All of the above figures are for acknowledged athletes. Another set of measurements, slightly different, is given by Warman in his *Scientific Physical Training.*

Proper Weight, Height and Measurement of a Fully Developed Man

Height	*Weight*	*Neck*	*Waist*	*Chest*	*Biceps*	*Calves*	*Fore-arm*	*Thighs*
5 ft. 4 in.	124	13	31	36–37			$10^{3}/_{4}$	19
5 ft. 5 in.	130	$13^{1}/_{2}$	$31^{1}/_{2}$	37–38	same		$10^{3}/_{4}$	20
5 ft. 6 in.	136	14	32	38–39	as		$11^{1}/_{8}$	21
5 ft. 7 in.	143	$14^{1}/_{2}$	$32^{1}/_{2}$	39–40	neck		$11^{1}/_{2}$	22
5 ft. 8 in.	150	15	33	40–41			$11^{7}/_{8}$	23
5 ft. 9 in.	160	$15^{1}/_{2}$	$33^{1}/_{2}$	41–42			$12^{1}/_{4}$	24

A perfectly developed woman usually stands between 5 ft. 3 in. and 5 ft. 7 inches in height.

We shall presently refer to the Venus de Milo as an artistic model and therefore will give her measurements as published and compared with another ancient and with a modern woman.

	Height	*Neck*	*Waist*	*Hips*	*Shoulders*	*Upper arm*	*Chest*	*Foot*
Venus de Milo	5 ft. 4 in.	14.8	31.2	40.8	41.1	13.2	34	10.4
Cleopatra	5 ft. 5 in.	13.7	29.3	39.6	40.	12.6	33.4	9.3
Annette Kellermann	5 ft. 4.7 in.	12.6	26.2	37.8	36.6	12.	33.1	9.0

(*New York Times*, November 20, 1916.)

Reproductive Organs.—We now come to an examination of the reproductive organs specifically. In days that have gone by these parts were considered either so sacred or so shameful as to be ignored entirely even by writers on health and diet and hygiene. There was plenty of instruction upon morality and right living in the abstract, but it was not linked up with the physical impulses and conditions in the concrete. A change is beginning to be observable. A young man drives a motor car after proper teaching, a young woman learns telegraphy, recently women are training for radio work, holding conversations with the unseen, perhaps sending S. O. S. calls for help that stir every one on sea and shore. If the youth of our land can manage so much mechanical power and control such marvelous scientific instruments they surely should understand more of their own personal powers.

The physical and mental efficiency of the next generation depends upon the character and form trans-

mitted to it by this. Sex anatomy need not be displayed from the house tops, but should have its proper share of serious attention; and sex physiology must receive respectful consideration from those who appreciate their responsibility in life.

MALE ANATOMY AND PHYSIOLOGY

The male organs concerned in generation and reproduction are partly within the body and partly outside of it. The most important are the testes or testicles, two in number, suspended in a sack or pouch of skin called the scrotum. This purse-like covering is very thin, never contains fat, but does contain muscle fibres that pucker or shrink up the sac when exposed to cold and then relax when the owner is warm or tired. As the left testis is usually somewhat larger than the right, the left half of the scrotum is usually correspondingly lower and larger than the opposite side.

The testes are exceedingly interesting and important glands. Their office is to form the sperm cells without which there could be no increase in the species. Each testis or testicle is a semi-hard ovoid gland an inch and a half long, by an inch wide and a little less in thickness. They are enclosed in a tough white cover (tunica albuginea = white tunic) and are smooth except where overlapped by the epididymis, a collection of tubes from within the gland. The testis is suspended by the spermatic cord and the blood vessels that nourish it. When cut through and examined with care the testicle is found to be made up of great quantities of fine tubes grouped in lobes or lobules. There are one or two hundred of the lobules, each containing two or three seminiferous tubes coiled and folded in a series of convolutions that when unravelled measure two feet long. These twenty-four inches multiplied by 800 or

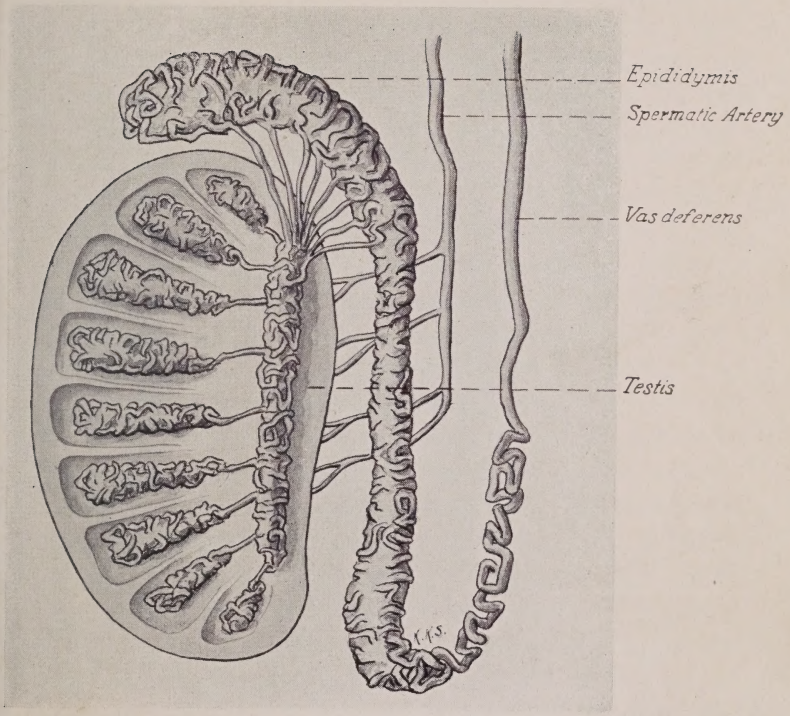

Plate XIII. Diagram to show the great number of seminiferous tubes and their coiled arrangement, a total length of more than five thousand feet, ending in the seminal vesicles inside the body. This is a factory whose products are life-giving sperm cells and a hormone, that wonderful element which circulating in the blood causes the individual to be a male.

900, the number of tubes, gives a total length of 1750 feet, a third of a mile. (Lauth.) According to the estimate of Monro the total length is 5208 feet, so that we might almost express the measure as mileage. Is it any wonder that sperm cells are provided by the million when they come from so elaborate a workshop? These tubes leave the lobules and pass by straight canals (tubuli recti) to the efferent (going away) ducts and thence to the epididymis, another series of folded and convoluted tubes. Plate XIII shows diagrammatically the various tubes of the testicle, and Plate XIV represents a section through the male pelvis showing the special organs concerned in reproduction. The spermatozoa are carried from the testis by the ductus deferens, unite with secretions from the seminal vesicles and the prostate gland, then leave the body through the urethra. The vesicles are like large irregular dilatations of the tubes themselves and are to be found lying back of and under the bladder. The dotted line shows clearly the route of the vas as it passes up in front of and then over the pubic bone, the bone so readily felt forming the front of the pelvis, whence it passes through an opening in the lower part of the abdominal wall called the inguinal canal, which may be felt through the skin immediately above the bone. This is the same opening through which the little testicle came down when first developed a month or two before birth in the forming child. It becomes a very well known part of the body because many persons are so unfortunate as to strain themselves in jumping or lifting and to force a portion of the bowel (intestine) through the same opening. That constitutes *hernia* or rupture. Returning to the

vas deferens we find it to be about eighteen inches long and terminating in the vesicles lying as mentioned, between the bladder and the rectum. The vesicles are irregular in shape because saculated or pocketed; they are about two inches in length and terminate in ducts that seem to be lost in the prostate gland. The ducts are called the ejaculatory ducts as they throw their contents (the semen) forward when needed into the urethra and so on out of the body. The plate shows clearly also the position of the urethra as it extends from the bladder through the prostate gland. The prostate gland is important as it is one of the group of generative glands. It is about the size of the large French chestnut and is usually described as being made up of three lobes. It is found to enlarge in animals during the breeding season just as the testes do. In man it often enlarges in old age and presents a condition of most serious disease because it acts as a dam and prevents proper emptying of the bladder. There are two more structures that should be mentioned: Cowper's glands, about the size of peas, to be found lying next to the urethra just before it enters the penis. They are not shown in the illustration. They also contribute some secretion to the composite fluid, the semen (seed). It is not uncommon for the seminal vesicles to unload their contents of their own accord as it were, especially at night. These nocturnal emissions (wet dreams) are often misunderstood, but are really nature's way of relieving vessels that may be over full. It is a perfectly normal procedure for rugged and virile youths and does not indicate loss of manhood nor should the occurrence cause dreadful forebodings of any kind.

The testes are not always carried outside the body as in man, but may be permanently inside as found in elephants, or appear outside during the mating season only as is the case with squirrels and other rodents.

The next important organ, the penis, serves both the generative and the urinary systems. The penis is made up primarily of three bundles of tissue, the two chief ones being the corpora cavernosa or, in simple English, the bodies of caverns, hollows or cells. These begin on the under side of the pelvic bone and terminate in the glans, the end part of the penis. Beneath these two is the third spongy body that encloses the urethra, the canal of exit from the bladder. The skin enveloping the organ is thin, contains no fat, and extends over the glans, forming a protective cover termed the fore-skin. The glans is a very sensitive part and may be irritated by dirt or secretions collecting under the fore-skin, wherefore boys should be taught from childhood up to keep this part very clean. The need for cleanliness was appreciated centuries ago and the fore-skin cut off by many people when the boy baby was a few days old (circumcision). The Hebrews of old made this procedure a rite of their church. It is practiced also by the Mohammedans and by many persons now-a-days for hygienic reasons and without regard to religious belief.

While the penis regularly coöperates with the bladder, it is also the intromittent organ of man and when introduced into the vagina of the female as occurs in the act of coitus, enables the sperm cells to be delivered directly to the womb. This cannot be under ordinary conditions, but only when sex excitement leads to the

engorgement and filling of all the spongy cells and cavernous tissue mentioned (orgasm). The organ is then erect and rigid, like a plant when all its cells are full to the limit with water, *i. e.*, sap. The nervous control of these processes, although influenced by impulses from the brain, such as erotic desires and thought, is in the lumbar or lower part of the spinal cord. In some of the lower animals, in addition to the structures named as forming the penis, there is a retractor muscle. The horse, cat and dog are so equipped, but not man.

Sperm cells, spermatozoa, are shown in Figure 4 as they appear under a high-power microscope. They are not unlike minute tadpoles, that is they have a globular head, a narrower neck and a long threadlike tail. The head is one five-thousandth part of an inch in length and the tail many times longer. Five hundred of the cells, tail and all, would have to be placed end to end to measure an inch. The tail is the motive power and enables the sperms to swim against the currents found in the female uterus and tubes. The cells are very tenacious of life and do not succumb readily. Keibel found live spermatozoa obtained from a criminal three days after his execution. They have been found alive in the tubes and uterus three and a half weeks after coitus. (Prentis and Arey.) Bats mate in the autumn and the sperms are retained in the uterus of the female until the following spring when she develops ova that may be fertilized. (Howell.)

Electricity in the form of Röntgen ray destroys the life of either sperms or ova. Therefore persons who have much occasion to use X-ray apparatus need to

protect themselves lest they be sterilized. Sheets of lead or rubber prevent Röntgen rays from passing.

The semen (seed) is a white fluid, with an odor peculiar to itself, and the most important ingredient

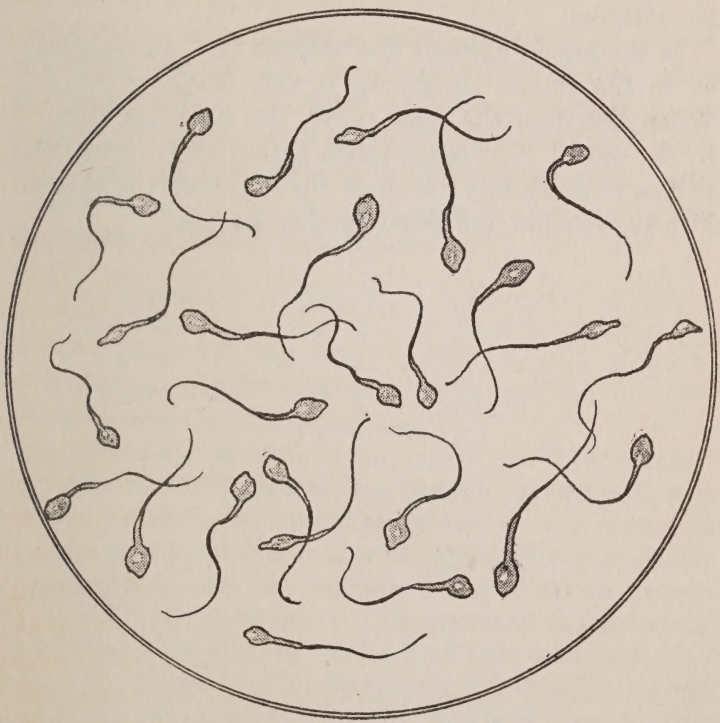

Figure 4. Spermatozoa magnified five hundred diameters. Each spermatozoon (sperm cell) consists of a head, nearly oval, a short thickened neck and a very long tail. By means of the latter the sperm swims in the fluids surrounding it.

of which is sperm cells. They are estimated to number more than 200 million at each ejaculation although one only is needed to fertilize an ovum, egg. The other elements in the fluid are supplied by the epididy-

mis, the seminal vesicles, the prostate gland and Cowper's glands; and while the nature of the secretions of these organs is not well understood, experiments upon animals prove the product of each to be necessary to fecundation.

In the higher animals the nervous system, especially as to the sexual apparatus, is very finely organized. When therefore the sexes unite, the impulses referred to the spinal cord cause reflex action and contraction of the seminal tubes so that their contents is thrown into the urethra and thence makes its exit.

WOMAN

For the normal figure of woman there is no model better adapted to our purpose than that of the Venus di Milo, Plate XVI. Here we have a figure of great dignity and beauty in a natural pose and with a facial expression, all so alluring that while the statue is badly damaged, she holds the attention of the world. In the words of an unknown writer:

> "So chaste and noble is the ideal and so wonderful the technical execution that the effect is incomparable to anything else in art. She is at the same time a woman of indescribable youth and beauty and the majestic incarnation of all-powerful love."
>
> "The master piece in the Louvre . . . The Venus of Milo is neither elegant, nor dreamy, nor nervous, nor impassioned; she is strong and serene. Her beauty is all noble simplicity and calm dignity, like that of the Parthenon and its sculptures. Is not this the reason the statue has become and has remained so popular, in spite of the mystery of the much discussed attitude? Agitated and feverish generations see in it the highest expression of the quality they most lack, that serenity which is not apathy, but the equanimity of mental and bodily health." Reinach, in *Apollo.*

All the lines are curves that please. Here we see elegance of pose rather than strength. In short, the figure answers to the definition of beauty, "That quality of an object by virtue of which the contemplation of it

excites pleasurable emotions." To be sure such grace charms. In man we noted the broad shoulders, but in woman the width is in the hips, the woman is the child-bearer, the mother. Her pelvis is broad and shallow to accommodate those wondrous organs that undergo such marvelous changes as the child develops within. Moreover the space between the two pelvic bones forms a different arch in the two sexes; a high, narrow, Gothic arch in the male, but a wider, rounder, Roman arch in the female, from under which the child arrives.

Within that pelvis lie the uterus and the ovaries. In the latter the ova or eggs are formed and upon them the perpetuation of the race depends. To quote rather freely from Meigs: "There is no animal germ without it (ovary)—so that an organ so small, so unobvious, is endued with the vast responsibility of keeping up the living scheme of the world—with its moralities—its lives—its actions—its trials—which, were it to cease, there would be left no flowers to bloom, no insects to sport in the evening shades, no choral song of birds, no lowing of cattle, no bleating of flocks, nor voices of men to thank and praise and acknowledge the author of every good and perfect gift.

> "Think of that great power—and ask whether such an organ can be of little influence on the constitution of the woman; whether *she* was not made, in order that *it* should be made, and whether it may not on occasion, become a disturbing radiator in her economy, . . . and that her ovary is her sex—and that she is peculiar because of, and in order that she might have, this great, dominant organ concealed within the recesses of her body."

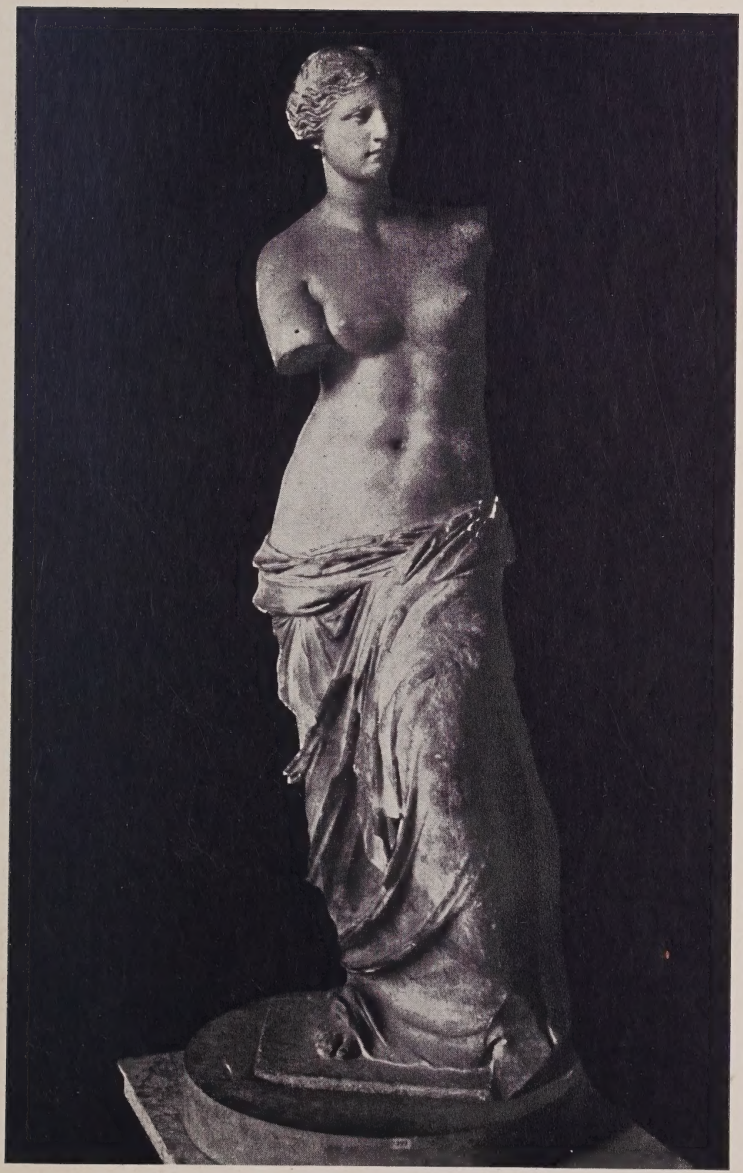

Plate XVI. Venus of Melos. Second century, B. C.

FEMALE ANATOMY AND PHYSIOLOGY

The generative organs of woman are partly outside of and partly within the body. If we look into the female pelvis from above when the intestines have been removed we see prominently in the middle a smooth pear-shaped body, the uterus or womb (Plate XV). The uterus is about in the middle from side to side, also from before backward; it is suspended and kept in place by ligaments that because of their character are named *broad.* Included in these ligaments about two inches away from the womb are to be found the ovaries, one to the right side and one to the left side.

Beyond the ovary on each side may be seen the fringed end of the oviduct, which appears like a great number of little fingers around the opening of the tube. See Plate XVII. The ovary is a semi-hard body, measuring one inch long by three quarters of an inch wide and half an inch thick, having the general appearance of an almond. This is a small gland but of paramount importance, because its office is to produce the ova or eggs. In structure and use it is analogous to the testis of man. The ovary varies in size with age and activity. The outside cover is tough and white. Within are found thousands of cells in which the eggs are being developed. Since the young Dutch physician De Graaf made his celebrated researches (1641–1673) the cells have been called by his name, Graafian follicles. They number between twenty and forty thousand

little cavities, a tenth of an inch across. At the age of puberty the sex glands enlarge and begin to functionate, that is become active. The ovary is the essential organ of woman and at this time the ova, eggs, begin to form near the surface, and once in twenty-eight days a mature ovum breaks through the covering and is immediately caught up by the fringed oviduct or tube mentioned above. See Plate XVII. The opening through the tube is, at its narrowest portion, only large enough to admit a good sized bristle; but even that is room enough, as the tiny egg is only one one-hundred and twenty-fifth of an inch in diameter. Moreover the tube is lined with cells that are ciliated, that is, have little hairs, and these are at all times waving the ovum along on its journey to the uterus. The uterus or womb may be described as a muscular organ that measures three inches high by two inches wide, and about an inch in thickness in a virgin. When a mother is carrying a child during pregnancy, the uterus grows enormously and after the birth of the child the organ never returns quite to the small size of virginity. The uterus always lies between the bladder and the rectum, but its exact position depends upon the emptiness or fullness of these organs. Since three such important organs are so closely situated in the pelvis it is evident that a woman should be careful to keep each in a normal condition and not allow constipation to persist nor permit the bladder to become overfull. On examining the uterus we find it broad at the top, constricted lower down as if having a neck (cervix), and then terminating in an opening below, termed the mouth of the womb. The uterus appears to

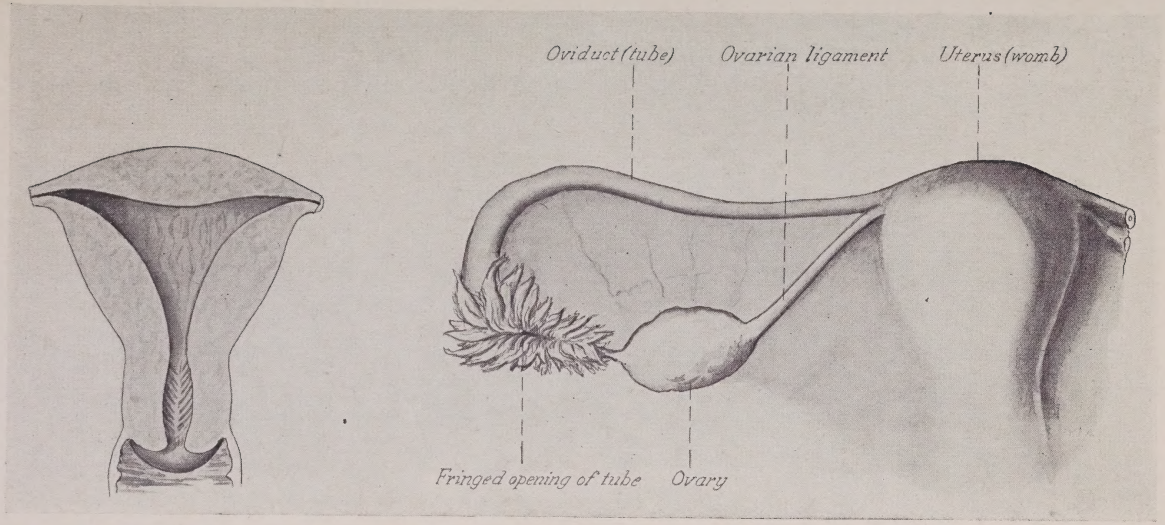

Plate XVII. Uterus or womb with the ovary and tube or duct. At the left is shown a section of the uterus. Note the very firm and thick walls. This is the "nest" of which we tell very young children.

be set down into the vagina much as an egg rests in an egg cup. The cavity in the uterus is exceedingly small as compared with the size of the entire organ; but this is not to be wondered at since it serves as a canal most of the time, and becomes active only at the times of menstruation and pregnancy. Once every month, at the time of the maturing of an ovum, there is great congestion and thickening of the membranes lining the uterus and a flow of blood and cast-off lining that lasts from three to five days. This is known as menstruation because it occurs once a month. In the lower animals this process occurs only once or twice each year, when the animal is said to be "in heat" or "rut." Many lower animals have more than one uterus.

The next part to consider is the Vagina (see Plate XV), a very dilatable tube or passage leading from the uterus to the outer genitals. It is made up of thin muscle and mucous membrane and ends below at the hymen, a thin partition or door separating the internal from the outer genital organs. Vagina means sheath or scabbard: it is "the sacred vestibule to the great arcana of procreation." Through this passageway at the time of coitus the male fluid with the sperm cells is conveyed directly to the uterus on the way to meet the ova or eggs. The vagina is ordinarily collapsed, but is capable of great expansion, as at the time of child-birth when it becomes the canal of exit to the outside world.

The hymen is a thin membrane which if present separates the vagina from the outer organs. It is of various shapes, sometimes completely surrounding the opening, often being only a crescent; its presence

in complete form was once thought to be a test of virginity; but it by no means follows that its absence proves lack of purity. Accidents in childhood or later may cause its destruction, or it may never have been perfect. To the common people the hymen is known as the maidenhead and many honest though ignorant persons have been greatly misled concerning it.

The external genitals consist of the mons veneris, the fatty eminence at the front of the pelvis, covered by hair at maturity, and the vulva. The vulva is the genital cleft which conceals the entrance to the vagina; it consists of the larger lips (labia majora) composed of integument, *i. e.*, skin, and the lesser lips (labia minora) also called nymphae, composed of delicate mucous membrane. Beneath the labiae is a certain amount of erectile tissue, and it might be mentioned that there is also such tissue in the walls of the vagina.

At the front of the vulva, where the labia minora of the two sides join, is found the clitoris, the special seat of sex sense in the female. This is an organ of the same sort as the penis of the male, composed like it of cavernous bodies that go back to the pelvic bones for attachment, and containing also spongy erectile tissue. It ends in a glans and is covered by a small fold of membrane like the foreskin. As in the male, these parts may become adherent and lead to bad habits or, in adults, to nervous complaints. Perfect cleanliness is the proper preventive of trouble in either sex. There are two glands (Glands of Bartholini) just back of the labia that secrete a lubricating substance which is poured out through ducts in front of the hymen. These are analogous to the glands of Cowper in the male.

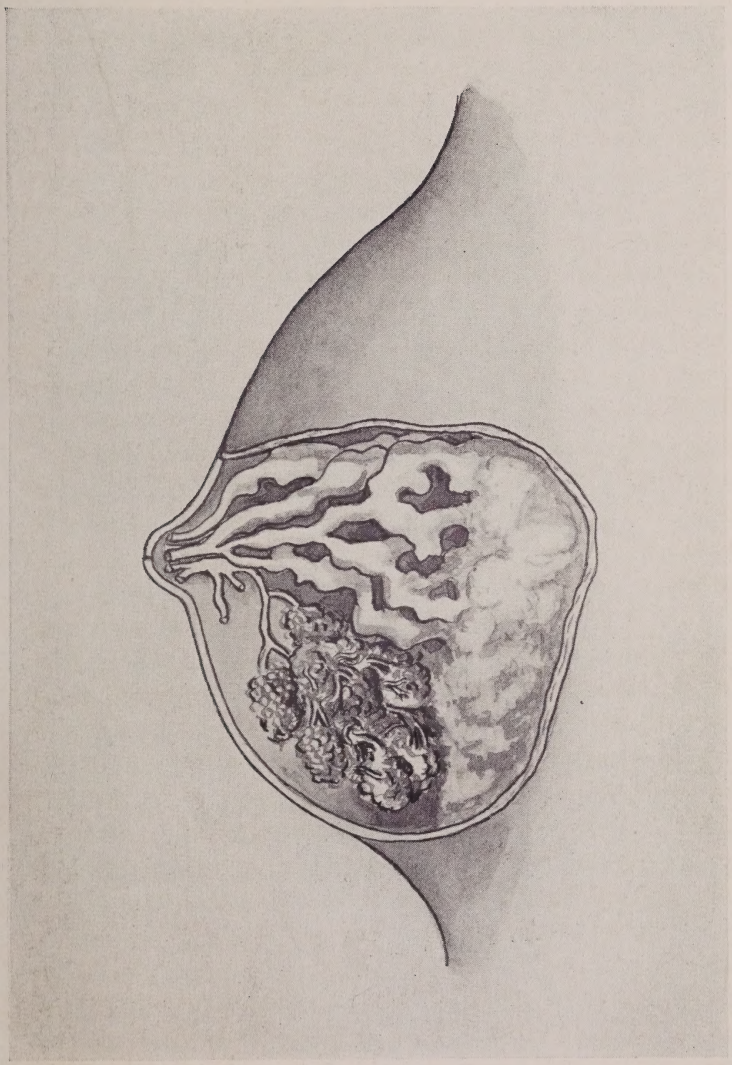

Plate XVIII. The mammary gland or breast. The diagram shows various degrees of dissection and how the milk ducts are all directed to the nipple. Redrawn from DeLee. Courtesy W. B. Saunders Co.

Below the clitoris and above the vaginal opening is the urethra, the outlet for the bladder, though it is not strictly a part of the genital tract.

The Breast (Plate XVIII) is a secondary organ of reproduction, but very important. It is the breast or mamma that gives the name to a large branch of the animal kingdom, namely mammalia, *i. e.*, those who nurse their young. Moreover we here derive one of the sweetest words of our language, the child's loving name for its mother, Mamma. A rudimentary breast is present in the young baby whether boy or girl, but it does not develop into a useful organ except in the female, and then only functionates as a producer of nourishment, milk, after a child is born. The mammary glands may be only two in number as in woman and in the horse (mare), or four as in the cow, which has these held in one sac called an udder. Those animals bearing several young at a time are of course provided with multiple breasts, as the cat family, swine, etc. The position of the mammary glands varies very much, for example in man and the whale the breasts are upon the upper and front of the chest, whereas the goat and mare carry the glands in the inguinal region, back near the pelvis. On the other hand the mother cat or dog (bitch), having a number of little ones at a birth, is equipped with a double row of glands extending from the chest all along the belly to the pelvic region. With what delight children at the farm watch a dozen little pigs guzzling down their dinners. (See Plate XI, p. 48.)

The breasts of the young maiden are not much more prominent than those of her brother until puberty approaches, when they enlarge very definitely and

round out to conform to the development of the owner, being tight and small in thin persons, but containing fat and soft tissue in those persons of an adipose tendency. In either case the structure is essentially the same, a bundle of fifteen or twenty milk tubes (lactiferous ducts), with one end opening at the nipple and the other branching like a tree into many small tubes and finally dilating in blind pockets lined with cells that will turn to be milk globules when the proper time comes. The skin about the nipple is very delicate, and is of a pinkish color in blonds and dark in brunettes. The color is darker in those who nurse than in those who do not. With many women the breast enlarges and becomes hard at the time of the menses, showing the intimate relation between these glands and the uterus and ovaries. The breasts of some African women are so movable and pendant that a mother, even when she is trekking across the inland wastes or through the forests, is able to suckle her infant as it rides upon her back.

The close relation between the breasts and uterus is of great practical importance to mothers, for it is well known that those who nurse their children are less liable to have "female complaints" than those who do not.

DUCTLESS GLANDS AND HORMONES

The glands without ducts have been recognized by the anatomists for ages, but their uses have been little known until recent times, and some of them are not fully understood even now.

These glands secrete substances required by the system but carried in the blood current instead of being delivered through tubes or ducts as is the saliva and the bile. Moreover these glands influence other glands and function at a distance; they act as messengers causing activity and coöperation in other parts of the body. Hormone (to excite) is the term used to describe this energizing of one part of the body by another. For example, the suprarenal gland (over the kidney) excites to contraction the blood vessels throughout the body.

The gland best known is the thyroid, found in the neck just below the larynx (Adam's apple). It is composed of two lobes each about two inches high, lying at the sides of the trachea (the wind pipe), connected in front by an isthmus of vascular tissue like that of the lobes. This body begins to grow noticeably at puberty, and besides being very much concerned with growth and nutrition (metabolism), is related to the sex functions. If this gland fails to develop in a child, the body becomes stunted, heavy and unduly fat, the features become gross, the skin dry, the hair scanty and all the genital development is retarded;

and in addition to these physical changes the mind fails to develop so that the child is an imbecile, a Cretin. It happens at times that the gland undergoes degeneration after a person has grown to adult life, in which case there is a retrogression of sexual and other functions, as in the disorder called myxoedema. A person so afflicted grows heavy and becomes inactive in both body and mind.

The thyroid gland normally enlarges at each menstrual period, thus showing its close connection with the generative organs. It was once even the custom in France to measure the neck of a newly married woman to determine whether or not she were fulfilling her marital relations. The thyroid and the ovary were known to be related two thousand years ago, but the closeness of their interaction was not understood until very recent times. Removal of the thyroid causes a diminution of the activity of the suprarenal glands. The disease known as Goitre is due to enlargement of the thyroid gland, and the surgeon is sometimes called upon to remove a part or all of it.

The thymus gland also is found in the neck below the larynx, normally only in infants, as it begins to disappear from two years of age onward as the thyroid develops. It is related in some way to the testes, for castrated animals have the thymus grown to twice its normal size. It seems not to be so closely related to the female generative organs, although Klose and Vogt found increased development of both testes and ovaries after removal of the thymus, *i. e.*, thymectomy. Tadpoles fed on thymus do not change to frogs, but simply grow great without reaching maturity. The reverse is

true of thyroid, as frogs fed upon this gland mature rapidly although very diminutive in size.

The pituitary (mucous) gland is comparatively small, but very important. It is as large as the end of one's little finger or the size of a hazel nut, and is to be found under the brain, resting upon the sella turcica, a bony promontory like a Turk's saddle. The posterior part of this little pink body causes the blood vessels to contract, slows the heart, and influences sex organs by increasing the flow of milk in the breasts and producing contraction of the muscle fibres of the uterus. This last effect is so marked that pituitary extract is often given to aid in delayed child-birth. The pituitary exerts a remarkable influence upon growth in general and of the sex organs in particular. Clark found that hens fed upon pituitary glands laid an enormous number of eggs more than when without that food. When removed by accident, or experimentally in animals, growth is very much retarded and the sex organs remain undeveloped. The animal tends to become fat and sluggish. On the other hand if there be a tumor of the pituitary, causing greater activity than normal, there is precocious sexual development. Such an instance came under the observation of the writer. A small boy, almost infantile in character, changed in a few months to a bearded man with heavy voice and coarse features, and a few months later died. If there be deficiency of pituitary in early life, that is before adolescence, the boy will become feminine in type rather than masculine and growth will be very slow. If the thyroid be removed, the pituitary will increase markedly in size, as if endeavoring to take up the work of the absent member.

The suprarenals should be mentioned again to note that they cause increase of blood pressure by contracting the blood vessels and that they especially act on the uterus of the female and the vas deferens and seminal vesicles of the male. The whole gland enlarges during pregnancy, especially the cortex, *i. e.*, the outer layer, the bark.

The pineal (pine-cone) gland is another of the organs affecting sex characters. It is found in most of the vertebrates, in man being one-half the size of the pituitary. It is situated on the under side of the brain behind the third ventricle. Experiments with fowls, rabbits and puppies show that its destruction leads to rapid growth and early development of the testes and the secondary sex signs such as the comb and wattles of a cock. This little reddish-grey gland, also called epiphysis, was once thought to be the seat of the soul. It reaches its greatest development in lampreys and in certain lizards in which it terminates in an eye, the pineal eye. In our day we do not give the lizards credit for possessing such a "repository of imperishable truth."

We have now to describe the most important of all the glands influencing metabolism, namely the testes and ovaries.

Metabolism is the process in physiology by which foods simple or complicated are changed into living tissue, blood and muscle, energy, heat, etc. Plant life grows from elements derived from the earth, air and water; animals live upon plants, vegetables, air and water. We humans are nourished by using as food both animal and vegetable life as well as air and

water. The character of growth, amount of energy expended and degree of vitality varies in the two sexes and at different ages. The testes and ovaries are among the governing bodies in these physiological and chemical processes of nature.

Removal of the testicles in male animals, emasculating them, is termed castrating or gelding. The name gelding is applied especially to horses. The practice of depriving young males of the testes has prevailed as a commercial measure from time immemorial because such action changes the normal character of the animal and also his manner of growth. If the young colt is operated on, instead of a fiery stallion we have a gentle gelding; if a bullock, instead of being compassed about by the bulls of Bashan, we have the patient oxen; if the young sheep is "altered," we have instead of the pugnacious ram the quiet wether, perhaps the one that wears the bell and leads the flock. To quote Chaucer, "And softer than the wolle is of a *wether*." The wild boar with prospective tusks becomes a quiet fat porker; the young cockerel in the farm yard fails to develop the beautiful comb and long tail feathers, the spurs also fail and Chanticleer becomes the capon for the epicure. The reader may recall the Chevalier in *Pendennis*, "ready to execute any commission for his patron, whether it was to sing a song or meet a lawyer, to fight a duel, or *to carve a capon*." The stag, if robbed of his testes, will no longer grow antlers. After operation plumes do not grow on male birds, neither combs, wattles, spurs nor distinctive tails. Excessive mane does not grow on mammals, nor horns unless they are character-

istic of both sexes of the species. In fact the secondary male characters are all held in abeyance.

The ductless glands are all affected in some degree by castration, for instance, the thyroid mentioned above is diminished in size, while the suprarenal cortex and pituitary increase. The thymus does not diminish as is usually the case in the young, but remains the same or actually increases in size.

Although sex is our particular subject it may be mentioned that all these glands affect nutrition. It is especially noticeable that removal of the testes leads to lengthening of the long bones and the tendency to lay on fat. In fact this latter effect is the real reason for operating upon sheep and swine. Breeders even say that the meat of castrated animals has an odor different from those otherwise normal.

As male animals win the females largely by fighting and asserting superiority in the herd, castrating them renders them more docile and safer to deal with in any domestic way. Cats ("Thomas cats") and dogs are operated upon that they may have no incentive to leave home and also that they may not reproduce indiscriminately. Castrated animals lose sex passion of course and also are less courageous and somewhat less strong. Dogs and wolves must realize the value of these organs as they are known to remove them from their foes in fighting.

A man who suffers loss of the testes from accident, disease or surgical procedure is called a eunuch. In the Far East it is customary to have the harem, or women in a polygamous household, under the charge of a eunuch who naturally has lost virility, but may be

a very able administrator. Many eunuchs in history have attained great distinction and influence. It was once a custom in Italy to operate on boys in order that they might retain the soprano voice.

In Russia there is a religious sect, the Skopzen, who practice castration of the males. Eunuchs are said to "lack the courage, passion and aspirations of ordinary man; are tricky, revengeful and cruel." They grow tall, have long bones, a larynx like a child, a delicate pale skin, often wrinkled and yellowish in color. The shoulders and pelvis are narrow, pads of fat form over the stomach, in the mons Veneris, on the hips, buttocks and thighs. Such individuals are apt to have a low temperature, to suffer from cold hands and feet and generally to give evidence of low vitality.

The essential glands of the female are the ovaries; removing them is called *spaying;* it unsexes the animal and as no ova or eggs of any kind are formed by her, renders her incapable of reproduction. The operation is sometimes done on hens in order to promote rapid growth and a sweeter and more juicy meat. Domestic pets are so treated, not from kindness but to prevent "the bar sinister," the introduction of fifty-seven varieties.

When the ovum leaves the ovary a blood clot forms there which is accompanied and surrounded by cells from the wall of the Graafian follicle. If the animal conceives, this mass becomes organized tissue of a yellow color and is therefore called the corpus luteum (yellow body). This yellow body has very great value to the person as it is the vitalizer of the uterus, causes

it to grow, causes the breasts to develop, the milk to be secreted, and develops hormones.

Loss of the ovaries is not common in young girls before puberty, though it unfortunately is common in later life (See chapter on Purity). When a woman is deprived of her ovaries there is, in 78 per cent. of instances, a loss of sexual instinct and, in 57.5 per cent. of them, an increase in weight. (Gloevecke.) Such persons lack the vitality they previously had, as shown by the experiments of Zuntz, who demonstrated that they consume 20 per cent. less oxygen than do normal women (See Falta-Meyers).

Removal of the ovaries brings about an artificial menopause with its usual symptoms, emotional excitement, anxiety, fretfulness, fainting, flushings and disturbance of circulation, cold feet and hands, weakness of memory, etc. If the removal is before puberty, the mammae (breasts) remain child-like, hair does not grow under the arms nor upon the pubic region. Similarly the male has no beard and little hair on the body if the testes be removed early in life.

SEX DIFFERENCES

Sex is a word of wonderful meaning. To a sallow, sorrowful spinster it suggests sin, and savors of the sewer; to a ruddy roisterer it implies a riot of debauchery and self-indulgence in sensuous pleasure; to the normal person sex signifies the profound and marvelous fact that running through nature there are two sorts of beings, male and female, and that without their union neither of the former would be perpetuated. The distinctions of sex are to be found not in anatomy only. In all the animal kingdom sex influences the aims, actions, deportment, behavior, mentality, psychology, and character.

"Sex contains all,
Bodies, souls, meanings, proofs, purities, delicacies, results, promulgations,
Songs, commands, health, pride, the maternal mystery.

* * * * * * *

All hopes, benefactions, bestowals,
All the passions, loves, beauties, delights of the earth,
All the governments, judges, gods, follow'd persons of the earth,
These are contain'd in sex, as parts of itself, and justifications of itself.

* * * * * * *

If anything is sacred, the human body is sacred,
And the glory and sweet of a man, is the token of manhood untainted;
And in man or woman, a clean, strong, firm-fibred body is beautiful as the most beautiful face.

* * * * * * *

O my Body! I dare not desert the likes of you in other men and women, nor the likes of the parts of you;
I believe the likes of you are to stand or fall with the likes of the Soul (and that they are the Soul;),

* * * * * * *

The female contains all qualities, and tempers them—she is in her place, and moves with perfect balance;
She is all things duly veil'd—she is both passive and active;
She is to conceive daughters as well as sons, and sons as well as daughters.

* * * * * * *

The great chastity of paternity, to match the great chastity of maternity.

* * * * * * *

The consequent meanness of me should I skulk or find myself indecent, while birds and animals never once skulk or find themselves indecent."

WALT WHITMAN.

While we are not ready to admit that the body and soul are one, we will allow the poet liberty in his apotheosis of the human form and try to treat with respect the body that contains the soul.

This same sentiment is found in Spenser's

"AN HYMNE IN HONOUR OF BEAUTIE"

"For of the soule the bodie forme doth take;
For soule is forme, and doth the bodie make.
Therefore, wherever thou doest behold
A comely corpse,[1] with beautie faire endewed,
Know this for certaine, that the same doth hold
A beauteous soule with fair conditions thewed,[2]
Fit to receive the seeds of virtue strewed;
For all that faire is, is by nature good."

Men and women naturally have many points in common both physical and also mental, yet there are very distinct differences, some of which we will note.

The average weight of the Caucasian brain differs in the sexes, being 50 ounces in man and only 44 ounces in woman; however it should be remembered that woman's total weight is less than that of man. Weight is not an index of the sort of organization and is only in a general way indicative of the degree of intelligence. The nervous system in the female is in many respects the more highly organized. Woman for instance, has a finer sense of touch than has man, she is more sensitive to pain, yet endures pain and discomfort better than man does. In the matter of the use of clothing the sexes differ, man usually being dressed in far thicker apparel than woman. How far back in history gauzy sleeves and no sleeves have prevailed we do not know, but in the Sixteenth Century Bouchet observed that women endured cold better than men and required less clothing.

[1] Corpse, body. [2] Thewed, endowed with fair qualities.

One of the best books on the subject of sex differences and similarities is by Havelock Ellis, *Man and Woman*, a work full of both general statements and statistical reports from a very wide field. We have found many of the following observations in this book.

Beginning with the senses, sight defects of serious nature are most common in men, while simple defects of errors of vision, are most common in women; color blindness, for instance, being nearly ten times as prevalent in men as it is in women. The sense of taste is more delicate in women, but the experiments to measure hearing give contradictory findings. Man's muscular strength is without experiment admittedly greater than that of woman. Research gives more definite impressions. Whitney says that a man playing golf drives a ball 120 to 140 yards, whereas a woman usually drives only 70 or 100 yards. Men are given to more violent muscular activity in general, and their muscular strength is reckoned as fifty per cent. greater than that of woman. "It was not an accident that at Pompeii and Herculaneum, while men were found in a state indicating violent muscular efforts of resistance, the women were in a condition of resigned despair, or clasping their children."

The mentality of children of both sexes is much the same until they near puberty when changes are noticeable, the changes occuring about two years earlier in girls than in boys. Girls have the better memories and have a style of composition unlike that of boys. The girls in writing excel in sympathy, sentiment, personality and the picturesque. When Jastrow asked fifty students to write rapidly one hundred words, the boys

gave the larger group of words to the animal kingdom, while the girls had the larger number of words that applied to wearing apparel, which accords with what we would think natural. German boys were found to give a large place to clothes, possibly because of military interest.

Heymans finds the mind of man massive and deliberate while woman's mind is quick to perceive and "nimble to act." Buckle says "men's minds are naturally inductive, women's deductive." Feminine quickness to think and act is not a product of civilization, but has been observed in the unlettered African as well.

Stanley Hall, who made such extensive studies of childhood, says that "children instinctively admire heroism and self-sacrifice earlier than they appreciate the sublimity of truth," to which Ellis adds "the same is true of women."

Man is egotistic, has his mind on his own deeds or worth; woman is vain, has her mind on her looks rather than works.

Woman, although she rarely founds a cult or new creed, is more religious than man. Heyman found by actual count that of six hundred sects only eight were originated by women. Women are fond of music, yet there are almost no great musical compositions by them. Women have written both prose and poetry, four names of great British women writers come to mind, the two Brontés, Jane Austen and George Eliot. By a study of the British Dictionary of National Biography, Ellis found, however, but 5.1 per cent of women among the great and noted. Mental stability is

curiously shown by statistics of suicide and crime. Among suicides men greatly predominate and usually hang themselves, while women prefer drowning. Stability of the nervous system is illustrated by reference to statistics of insanity. There are more men than women among the insane, but the insane women go to extremes even here, for they predominate in both the severe manias and the melancholias. Cloustan indicates the lack of self-control, perhaps unintentionally, in this statement: "There is ten times as much noise in the female (lunatic) wards as there is in the male wards."

Not only is lunacy more common in males than females, but so also is feeble-mindedness and idiocy. The writer was for twenty years connected with an institution for such cases where the census in 1913 was 450 males and 350 females.

Various writers record the fact that women are much given to untruth and to various sorts of cunning. Lombroso accounted for this trait by the fact that women are more compassionate and deceive themselves and their children, so that a habit of deception is formed; nor is this confined to the human family. The female is cautious from the natural habit of protecting her young, as may be observed in our domestic animals and in quails or partridges in the woods; it is said that those who catch monkeys can apprehend only one female to ten males.

Woman is less honest in acts too, for she will pilfer small articles that she may want, but not require. Witness the shop lifters who are practically all women.

After all, the greatest variations of body or mind

occur in the male sex, while women maintain an equable level. To quote again from Ellis, "Women it is true remain nearer than men to the infantile state; but on the other hand, men approach more nearly than women to the ape-like and senile state." "It is a metaphorical as well as a literal truth that the center of gravity is lower in women and less easily disturbed." If sex differences lead to difficulties in life they no less lead to its charms and satisfactions. Neither man nor woman is complete in self; each is the complement of the other.

Ellis sums up his chapter on the emotions of woman after this fashion: "In woman at puberty, as Dr. Campbell puts it, a new keyboard and a fresh series of pipes are added to the instrument," . . . however, "men and women will never be equal in emotionability."

> "The affectability of women exposes them, as I have had occasion to point out, to very diabolical manifestations. It is also the source of very much of what is most angelic in women—their impulses of tenderness, their compassion, their moods of divine childhood. Poets have racked their brains to express and account for this mixture of heaven and hell. We see that the key is a very simple one; both the heaven and hell of women are but aspects of the same physiological affectability. Seeing this, we may see, too, that those worthy persons who are anxious to cut off the devil's tail, might find if they succeeded, that they had also shorn the angel of her wings."

Women's habits and thoughts differ from man and also differ at various periods of life, just as those of men do. The young woman is likely to be of a more

or less romantic disposition, later to be absorbed with maternal desires or be engrossed with business thoughts according to her situation in life. The still older woman will be interested in the affairs of other people, her children or grandchildren, her neighborhood in school, church or state. Notwithstanding all this the fact remains that woman's real and essential sphere is in the home as mother and maker of destiny for husband and children.

It is a biological fact that only a woman can bear offspring and that she alone is physiologically able to give nourishment to the new life. She is also best fitted to give that nurture, moral and intellectual, that are for the upbuilding of the child's character while his body is growing. If she be a religious woman she will remember to quote "ye fathers, provoke not your children to wrath; but nurture them in the chastening and admonition of the Lord." The hen gathers her chickens under her wing, and the tigress of the jungle will give her life for her whelps, but it remains for woman to mould the character, and establish desirable habits in her child.

While we cannot too highly extol the honors and influences of motherhood it must not be forgotten that our modern society has brought about conditions that deny maternity to many women. Woman was once man's slave, then in the East his sensual toy, later she began to be educated and become his companion, now she has equal rights before the law, has the suffrage without military duty and has become his aid if not rival in three hundred kinds of wage earning.

In the United States we have more than half a mil-

lion women teachers, nearly as many stenographers and typists with clerks and saleswomen by the thousands. There is nothing to prevent women resigning at any time from these productive occupations to take up home life with its reproductive possibilities. It is not unusual for women to go from the home back to salaries when circumstances make it necessary. Woman is thus able to exert her abilities and gifts in many fields in many ways according to her endowments.

Man is combative, argumentative, given to reasoning out problems of home or of state, uses up large amounts of energy, is given to experiments, is capable of prolonged and severe mental effort, is apt to assert or imply superiority and lordship. Both primitive and civilized man follow the chase and go to war with their fellows. Woman rarely fights, at all events, physically.

Woman is more interested in home than in state matters, is quick of intuition, seeing the right or wrong of a situation without prolonged reasoning and argumentation, is more affectionate and of deeper sympathy than man. Woman is more spiritual and emotional, also more religious than man. Man is more apt to be the aggressor in matters of sex, he seeks out and proposes to the fair one he would wed. Biologically the man is the sperm producer, while the woman is the egg producer. Woman is the more patient and persistent in devotion to the offspring and in the making of home. Woman is said to excel in self-sacrifice, to have more of pity, and also to be more cruel than man. The lovers of Scott will recall

"O woman! in our hours of ease
Uncertain, coy, and hard to please,
And variable as the shade
By the light quivering aspen made;
When pain and anguish wring the brow,
A ministering angel thou!—"

To the above Ruskin says no, "but variable as the *light*, manifold in fair and serene division that it may take the color of all that it falls upon, and exalt it." The same writer continues, "But the woman's power is for rule, not for battle; and her intellect is not for invention or creation, but for sweet ordering, arrangement, and decision. She sees the qualities of things, their claims, and their places."

Ruskin states that Shakespeare has no heroes, only heroines, that his great men have weak points, *e. g.*, Caesar and Antony were very vain, and then comments upon "the charm, devotion, delicacy of feeling or grandeur in sacrifice of Desdemona, Viola, Rosalind or of Queen Catharine—all held higher than was common in the day of Shakespeare." Woman, "the only Divine work left unfinished" says Dumas fils. Woman is man's inspirer. Witness Dante and Beatrice; think of the number of books whose authors dedicate them to their wives.

Here are a few adjectives and phrases applied by Shakespeare to woman:

"Kindness," "her voice was ever soft, gentle and low"—"Women are soft, pitiful and flexible"—"her infinite variety." In the estimation of many, woman is not logical; for example, "No other but a woman's reason": "I think him so because I think him so."

Carlyle uses phrases like the following:

> "Meek and retiring by the softness of her nature, yet glowing with an ethereal ardour for all that is illustrious and lovely"; "veracity"; "fidelity to insight"; "compassionate;" "a loving, patient and noble heart"; "prudent"; "a gentle stoicism to endure much small unreason"; "capricious"; "whimsical"; "trustful"; "Women are born worshippers"; "with all the finer sensibilities of the heart; vivid in contradictory resolves"; "thought can hardly be said to exist in her; only Perception and Device"; "With delicate female tact, with fine female stoicism"; "Graceful, brave, amiable woman;—her choicest gift an open eye and heart"; "Every graceful and generous quality of womanhood harmoniously blended in her nature."

Ruskin writes after this fashion:

> "The woman's power is for rule not for battle,—and her intellect is not for invention or creation, but for sweet ordering, arranging, and decision." "She sees the qualities of things." "In speaking of the superiority of one sex to the other, as if they could be compared in similar things. Each has what the other has not; each completes the other and is completed by the other." "Wise, not for self-development, but for self-renunciation."

Thus writes Milton, with "his powerful and independent mind":

> "First granting as I do, it was a weakness
> In me, but incident to all our sex,
> Curiosity, inquisitive, importune
> Of secrets, then with like infirmity
> To publish them, both common female faults."

or from Paradise Lost:

" . . . . so absolute she seems
And in herself complete, so well to know
Her own, that what she wills to do or say
Seems wisest, virtuousest, discreetest, best."

Manly qualities as distinct from the above are courage, bravery, virility, nobility, boldness, daring, firmness, dauntless, dignity.

"Serene and manly, hardened to sustain the load of life."
Dryden.

"The great and masculine virtues, constancy, gravity, magnanimity, fortitude, fidelity and firmness." Burke.

The relation of the sexes to each other is well brought out in our frontispiece, Cot's beautiful picture entitled "The Storm." Read about these juvenile lovers in St. Pierre's romance, *Paul and Virginia*, as fascinating now as when written in 1788. The two children are brought up practically as brother and sister, but as they near nubility their natural instincts reveal to them that their affection is something other than fraternal and sisterly. For our purposes the picture illustrates trust and chivalry. The fair maiden, a blond type, is alarmed by the oncoming darkness and the turmoil of the elements. With an arm over his shoulder she seeks the protection of her life-long friend. The youth, a brunette just reaching manhood, less graceful but more vigorous, holds the maid's dress over their heads to keep off the rain, and with his arm about his companion's waist they race for shelter. The lass is anxious about the storm; but the face of the lad indicates no

weather-worry, only intense interest in his charge. We cannot begin too early to encourage chivalrous courtesy toward the weaker sex. We are told by Sumner that the age of chivalry has gone. It may be in the technical sense of horsemanship, but the gallantry that went with it should be preserved and the small boys should be brought up to so treat their sisters that in adult life they will be naturally true gentlemen. "When Knighthood Was in Flower" need not then be in the past tense.

"As unto the bow the cord is,
So unto the man is woman,
Though she bends him, she obeys him,
Though she draws him, yet she follows,
Useless each without the other!"
Thus the youthful Hiawatha
Said within himself and pondered,
Much perplexed by various feelings,
Listless, longing, hoping, fearing,
Dreaming still of Minnehaha,
Of the lovely Laughing Water
In the land of the Dacotahs."

Hiawatha—Longfellow.

FROM THE EGG TO BIRTH

David the king and poet may not have been a biologist, but he fully appreciated that he was wonderfully made:

"Wonderful are thy works;
And that my soul knoweth right well.
My frame was not hidden from thee
When I was made in secret;
And curiously wrought in the lowest parts of the earth.
Thine eyes did see mine unformed substance;
And in thy book they were all written,
Even the days that were ordained for me
When as yet there was none of them."

Psalm 139.

The simplest animals begin as cells which divide and grow, and divide again and grow; and the most highly developed sage or king began in the same manner, once an egg or simple cell.

In order to understand the progress of development in man it will be well for us to review the forms and development of some of the simpler lower animals, in which the processes of reproduction and growth can be easily observed under the microscope, and in which growth to maturity is completed in a comparatively short time.

As an example of the simplest form of animal, we may examine the Amoeba, a little creature consisting

Figure 5. Amoeba, a microscopic organism reproducing by dividing in two parts. (k) points to the nucleus. (v) points to the vacuole, clear space. After Schulze.

of but one cell. It is surely an animal because it takes in oxygen from the air, has the power of locomotion, the ability to take up nourishment, and to discharge waste material. It is found in water, especially in stagnant pools where it can feed upon the bacteria usually present there. In order to move from place to place it puts forth a long finger or foot of its protoplasmic body and draws itself after. To eat, it simply surrounds its prospective food and, having absorbed the nourishment, passes the waste into an open space, the vacuole (waste receptacle) from which it will later be expelled.

The plasma or protoplasm (Greek for "first form") is the body of the cell, but the nucleus is the important feature for continuance of the race, whether in amoeba or in a higher form of creature.

Reproduction in the amoeba takes place in a very simple manner as shown in Figure 5. The cell begins to lengthen and the nucleus does the same; the nucleus soon becomes narrowed at the middle like a dumbbell; the next stage shows the nucleus divided into two parts, the cell body becoming constricted, while in each of the clubbed ends will be found a portion of nucleus and also part of the vacuole. Further division will narrow the isthmus to a mere thread and then the two daughter cells will be free to pursue their own way of life and reproduction. The cells are constantly changing their shape and arrangement of arms, yet they maintain a characteristic form.

Rising higher in the animal kingdom we find cell division more complicated and correspondingly more interesting to study. The designs shown on Figure 6,

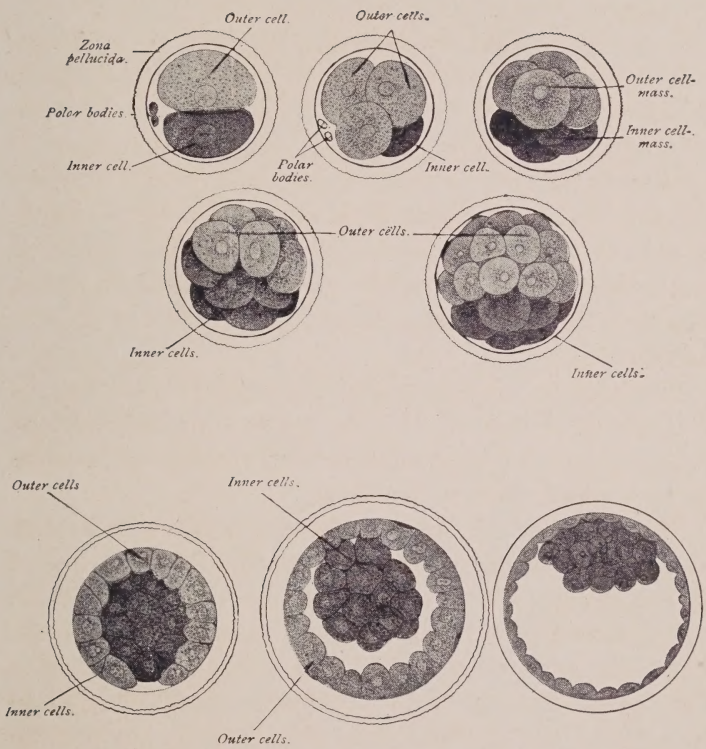

Plate XIX. Diagrams showing the cleavage in the ovum of a rabbit with formation of the blastodermic vesicle, or embryonic sphere. After Prentiss-Arey. Courtesy W. B. Saunders Co.

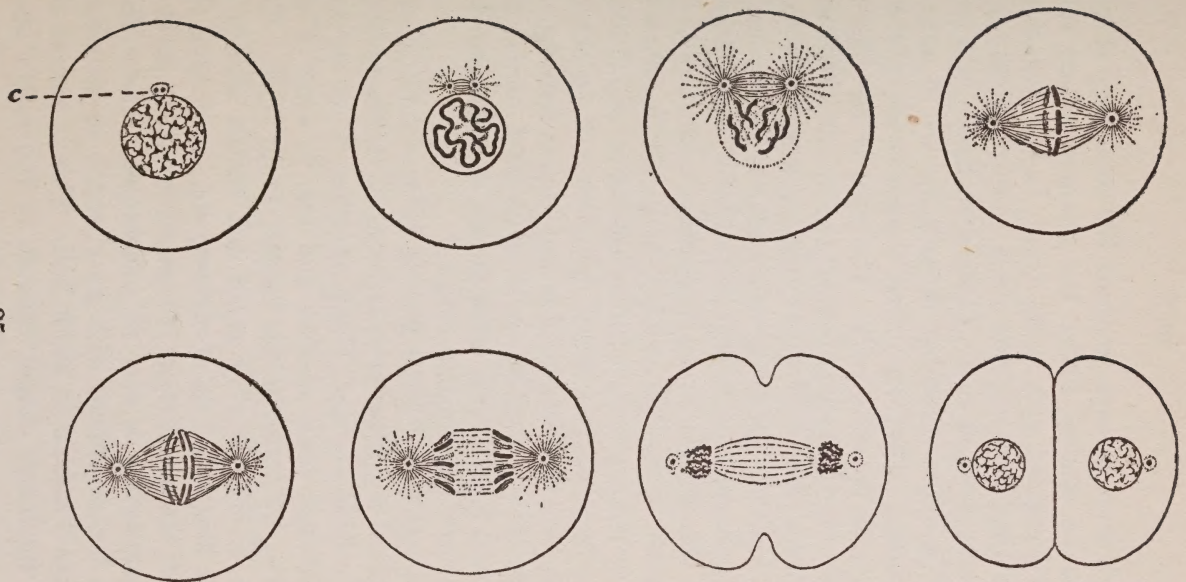

Figure 6. Stages of cell division (Karyokinesis). *c*, The centrosome, the determining force in cell division. See text. After Wilson-Weismann, Guenther.

although diagrammatic, indicate the steps very clearly. Cells to be studied under the microscope are more distinct if stained with anilin dyes. In the nucleus are threads that take up the color very definitely and look like a skein of silk. These soon break into little links of a definite number in each species of animal. (46 in man.) They are called chromosomes, which is merely Latin for color body. The color-bodies (chromosomes) form themselves around the spindle fibres as a belt at the equator. Such a formation if observed from the end has the appearance of a star, whence the name, the aster stage, aster being the Latin for star. At one side of the nucleus is an important little body, the centrosome, *i. e.*, the central body, or in common speech we could say the superior officer, for cell division seems to be under its control. A portion of the chromosome is found at either end of the spindle forming the star. As the cell matures it is divided across the middle and the divided centrosomes then become the nuclei of new independent cells.

The formation of cells having been described, the next process to engage our attention will be the development of cells in the egg. This is a process easily watched in the sponge, coral, starfish and also in some of the mammals, for instance the rabbit, Plate XIX. The division of cells is very rapid and occurs always in pairs, as two, four, eight, sixteen, etc., until soon the surface of the ovum (egg) is covered by a thin layer of cells constituting a sort of membrane. There then exists a hollow sphere with no strength or structure, not unlike a bubble or tennis ball. This is termed the morula (mulberry stage) because of the resemblance

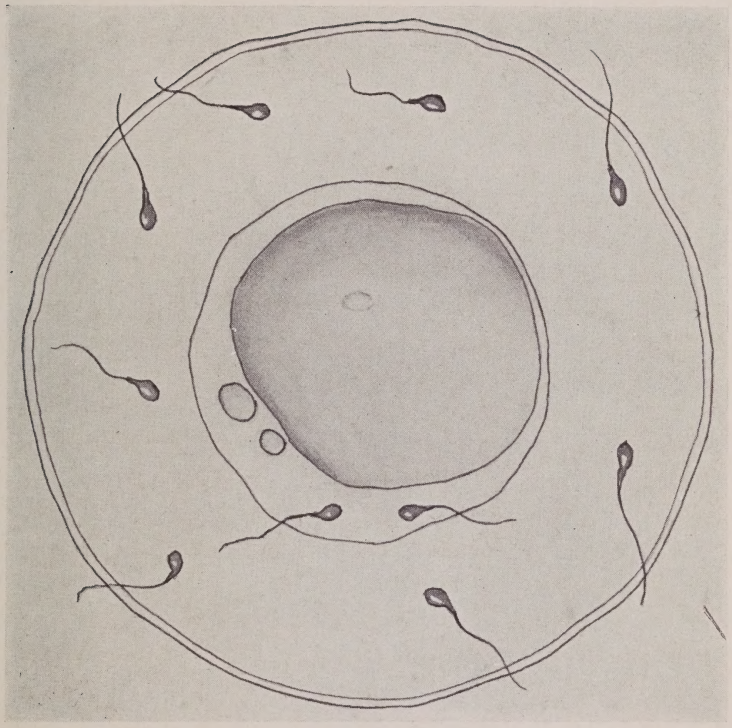

Plate XX. Spermatozoa entering the ovum.
Redrawn from Kollman-DeLee. Courtesy W. B. Saunders Co.

the ovum bears to the berry. An invisible thumb now seems to push in one side so that part of the outside becomes the inside lining and a sort of stomach is formed, this being called the gastrula (stomach) stage. These steps in the process of development of the ovum are clearly shown in the coral as pictured on Figure 7.

When the ripe ovum (egg) leaves the ovary of any animal it is destined to die in the tube or uterus unless it meets with a sperm cell and becomes fertilized. Figure XX shows the sperms trying to enter the ovum. When one enters there are changes that prevent another from entering. This fusion takes place usually in the oviduct of the female. When the sperm has united with the nucleus of the egg a new life starts, and the cell begins its process of dividing, called also cleavage or segmentation. Plate XIX illustrates the division of cells in the egg of the rabbit. Cleavage begins in fourteen or fifteen hours after the egg leaves the ovary of the rabbit and continues as the egg passes slowly along the tube, for it may be four days in reaching the uterus. Ovulation (egg leaving the ovary), occurs only after coitus in rabbits and cats, but in primates, including man, ova are thrown off at regular intervals without regard to contact with the male. Spermatozoa have already been described as very motile. Because of their whip-like tail they travel against the usual currents of circulation and may pass through the uterus and out to the end of the oviducts within two hours after sex union. They are also noted for tenacity of life. They have been found alive in the oviduct ten days and more after arrival within the human body.

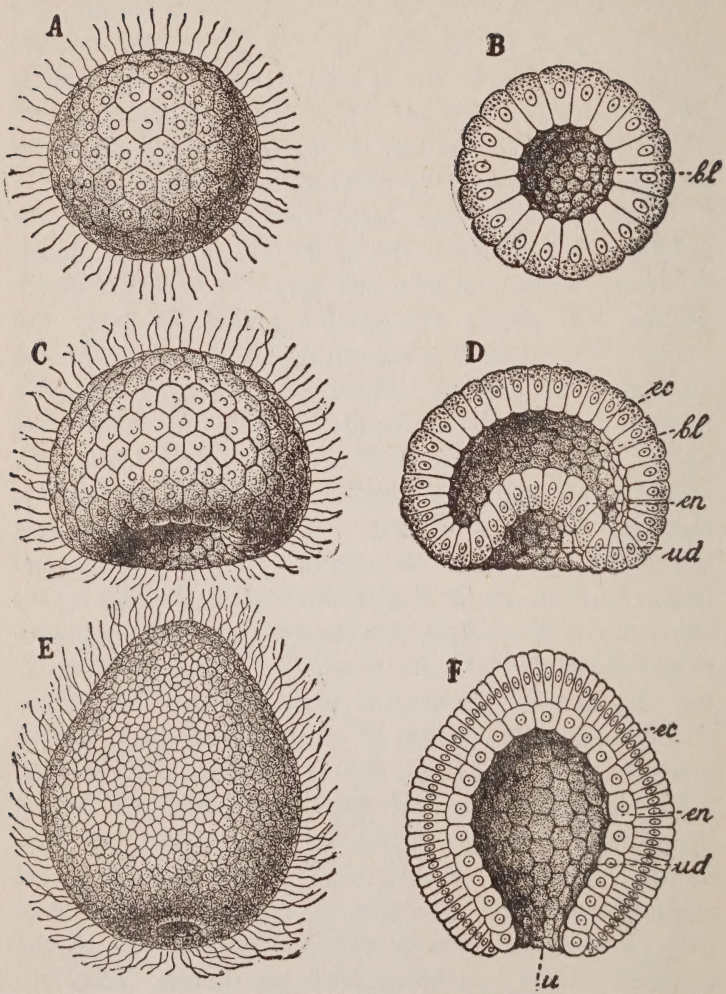

Figure 7. Formation of a gastrula in a coral. A, B, Blastula, a simple hollow ball; C, D, indentation of the ball forming an inner and outer wall; E, F, gastrula or stomach stage of development. *ec*, ectoderm or outer skin; *en*, entoderm or inner skin; *bl*, blastocöl or cavity. After Haeckel-Guenther.

Returning to the study of the rabbit's egg, as shown in the diagrams of Plate XIX we see that a part of the cells are very early folded in, as was the case in the coral. Thus there is formed an outer and an inner layer of cells, and between the two will soon be growing a third layer. These layers are named respectively, outer layer or skin (ectoderm), inner layer or skin (entoderm) and the middle layer or skin (mesoderm). These layers become very important to us later on when we study the various parts of the body that are formed from each layer.

After arriving in the uterus (womb) the egg undergoes very great changes as does the uterus. These processes may be considered to better advantage under the title, embryo or embryology.

EMBRYOLOGY

Embryology is the study of the young animal, bird or babe from the egg to birth. In the case of man the embryo is so named only for a period of about five weeks, after which it is termed a foetus until it is born.

Observations were carried on in early times as we know from the writings of Aristotle, who, four hundred years B. C. watched the development of a hen's egg daily. To be sure the microscope was not then in existence so that we of the present day have great advantages over the students of old. In those days it was believed that each animal was formed in miniature in the ovary, and that the male element was necessary merely to start growth and development. In 1677, Ham with his microscope discovered the spermatozoa, and in the same year de Graafe described the ovum in the ovary. At that time it was thought that the ovary contained in miniature all the future beings, the *preformation theory*. It was supposed that the addition of the sperm cells would cause the miniature individuals to develop. It was even computed by some one that the ovaries of mother Eve contained possibilities of two hundred million individuals after which the race must come to an end. Obviously there was a miscount. The theory of preformation or incasement gave place to the *theory of epigenesis*. Epigenesis is the accepted belief now, and signifies that the new life is *due to an equal combination of male and*

female elements and is not the unfolding of a pre-existing small individual.

Before taking up the development of the egg in detail, it is well to recall that the ova all have the same construction, but that the elements are in varying proportions in different animals. For example, the chick, like other birds, grows and thrives in the shell because it has the large rich yolk as a storehouse of food. Not so the frog; for it has very little yolk in the egg and must therefore be hatched very soon and get its growth during months of tadpole life.

In the case of mammals (nurse their young) there is yolk, but not a great amount of it because provision is made early for the embryo to get nourishment from the mother. Man is included in the family of mammals —a large family, by the way, containing more than 3,250 species.

Any one desiring to study the development of the egg, may arrange an incubator if hens are not available. If twenty-one eggs be placed under a hen she will keep them at her temperature of 102 to 104 degrees for twenty-one days when they will be old enough to hatch their way out of the shell. By removing an egg each day the student may, if he chooses to do so, follow the stages of development just as did Aristotle of old or Lillie of our own day. The study of mammalian development is less easy, and is usually left to professional biologists who make their observations largely on rabbits, guinea pigs and the like.

Beginning at the egg we find many spermatozoa trying to enter, as shown in Plate XX. One only will be successful. The gradual disappearance of the

yolk and the progressive formation of the placenta, which is the maternal trunk line of food supply, are indicated on Figure 8.

The first sign of an embryo in the egg is the formation of a little line on the surface, called the primitive trace; here the surface membrane separates along a little streak and each side is carefully folded under, not boldly as by the thumb imagined in describing the coral, but as if by the finest tools of a moulder. The dipping-in continues and at the same time the little embryo animal takes form, the yolk meantime getting smaller as its substance lessens to build up the new animal being organized. B on Figure 8 shows a sausage-like projection from the embryo, 6, which is the allantois, meaning sausage. This body grows rapidly to the under surface of the egg and later completely surrounds the embryo. Before the allantois has completely surrounded the embryo, blood vessels have appeared in it, and minute finger-like processes have grown out over the entire surface. G is an enlarged view of one of the villi or finger-like projections and shows the little loops of blood tubes. F shows the allantois now completely around the egg and growing thinner except at one side, as it encloses the embryo, like skin: from now on it is called the chorion (the Greek for skin). The hairy projections are gone except where about one-third of them cling to the mother's uterus and help to form the placenta, which is a mass of blood vessels from which the foetus gets its nourishment.

The finger-like projections make their way into the wall of the uterus, possibly by chemical action just as

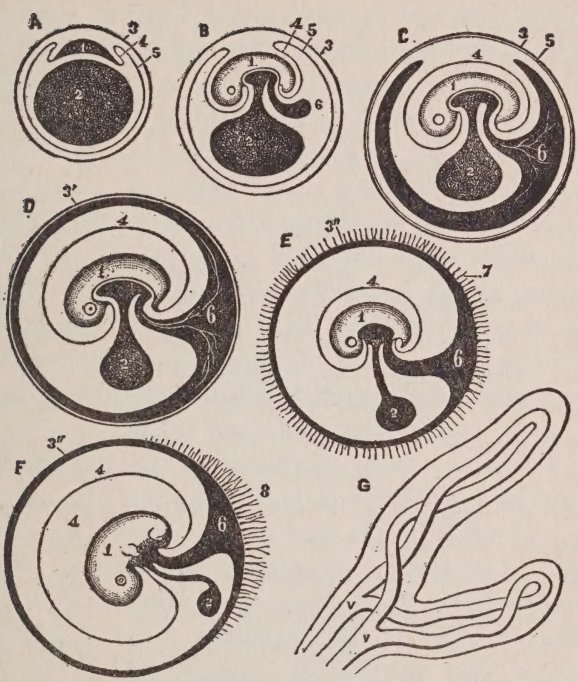

Figure 8. Illustrating the growth of the embryo and formation of the placenta, A–F.

1, The embryo; 2, the yolk absorbed by the embryo as its nourishment; as the embryo increases in size the yolk disappears; 3, vitteline membrane, outside cover; 3″ the chorion (skin) with villous projections which contain vessels to carry nourishment from the wall of the womb to the embryo; G, shows a villus enlarged 180 diameters; 4 and 5 are the inner and outer layers of the amnion, the sac that holds the fluid in which the foetus floats, "bag of waters." 6, Allantois (sausage shape) which grows steadily in size until it finally becomes the placenta. The placenta conveys nourishment from mother to foetus until birth.

pepsin digests its way into curds of milk; at all events they are mortised in so that the finished work is not unlike the mortising seen at the end of bureau drawers. By the time the placenta is well formed the yolk will have been all used, *i. e.*, absorbed so that only a mere cord of it remains. The placenta was so named because of its resemblance to a round cake, not a bad idea, as it is the source of nourishment for the young. However the analogy does not hold good in all animals; for instance, in the horse the placenta is diffused, in the dog and cat it is like a belt, while in sheep and cows it is in small patches. Someone has referred to the placenta as a stalk upon which the embryo grows as a fruit, a figure that contains some truth.

In following the development of the embryo closely we find that what was the outer layer of the egg (ectoderm) forms the skin and its accessories, as hair and nails, and in the lower animals the horns or feathers. From this layer the nervous system is also developed.

The inner layer, the entoderm, gives origin to the digestive and respiratory organs, the liver and a variety of glands, thymus, thyroids, prostate, etc. The middle layer, mesoderm, gives rise to the skeleton which supports the body and to the muscles that move it, also to the blood vessels which nourish all the organs.

Young embryos are much alike in all animals; even man has a tail like his relatives of other species, but it is soon out-grown. The head is a distinguishing mark very early because it seems to be disproportionately large, in fact constituting one-fourth of the weight of the entire embryo for some time. Without following

all the steps of growth, with the infoldings and the unfoldings, we may summarize in the beautiful description by Watson, "The original single cell divides and redivides rapidly, until a hollow ball of cells is formed. Then one-half of the ball is, as it were, pushed inside the other, so that a body like a double-walled cup is produced. The edges of this cup gradually grow together until only a small opening remains, which is the rudimentary mouth of the new animal. Very soon the backbone begins to be sketched in, the head is moulded off, and the limbs commence to grow out. The whole process is so remarkable that it looks as though an invisible hand were at work, drawing out here, pinching there, and gradually moulding a complete little copy of the parent form."

It will suffice for our purpose to note the chief changes of growth month by month. To begin with, we recall the fact that conception usually takes place within a week or ten days after menstruation and that the human family carry the young in the uterus for forty weeks, that is nine months.

The following weights and measurements, in the table on page 106, are as given in the metric system by Prentiss and Arey, who quote Mall and Fehling, to which, for the benefit of persons not familiar with that system, are added the more common avoirdupois equivalents:

Age	Length Crown-Heel (MM)	Length Crown-Heel Inches	Length Crown-rump (MM)	Length Crown-rump Inches	Weight Grams	Weight Avoirdupois	
Twenty-one days	0.5	.01	0.5	.01			
Twenty-eight "	2.5	0.09	2.5	0.09			
Thirty-five "	5.5	0.19	5.5	0.19			
Forty-two "	14.0	0.55	11.0	0.43			
Forty-nine "	19.0	0.74	17.0	0.56			
Second lunar mo.	30.0	1.18	25.0	0.98			
Third lunar "	98.0	3.85	68.0	2.67	20		$^5/_7$ Oz.
Fourth lunar "	180.0	7.08	121.0	4.76	120		$4^1/_4$ "
Fifth lunar "	250.0	9.84	167.0	6.57	285		10 "
Sixth lunar "	315.0	10.41	210.0	8.26	635	1 lb.	6 "
Seventh " "	370.0	14.56	245.0	9.64	1220	2 lbs.	10 "
Eighth " "	425.0	16.72	284.0	11.15	1700	3 lbs.	11 "
Ninth " "	470.0	18.15	316.0	12.44	2240	5 lbs.	
Tenth " "	500.0	19.68	345.0	13.58	3250	6 lbs.	12 "

There is considerable variation in the weights and measurements of the foetus as given by different authors, yet they agree in the main. Austin Flint adopted for his work on Physiology, the figures of Scanzoni as well as the latter's account of the appearance and growth of the various organs. We cannot do better than select from his findings.

At the third week the embryo is from a sixth to a quarter of an inch in length. The heart at that time is merely a single tube.

At the fourth or fifth week the cartilage is formed that will later change to vertebrae and make up the spine. At this time the head is very large in proportion to the remainder of the body, and is bent so far forward that the foetus looks at the upper part as though it had come packed in a square box.

At the sixth week the brain will develop folds and lobes and the head will begin to straighten up. The

heart consists of three chambers formed by the dilating and folding of the vascular tube mentioned. The heart of three cavities persists in fishes, but birds and mammals develop a fourth chamber.

At the seventh week the embryo measures about three-quarters of an inch in length. Points of ossification (bone) have appeared in the collar bone and the lower jaw. The liver is of large size and the lungs present several lobes. The internal organs of generation have just appeared. Blood flows through an oval opening from the right to the left auricle (the upper heart cavities).

At the eighth week the embryo is about an inch long. The lungs begin to receive blood from the pulmonary arteries. The external organs of generation appear, but it is difficult to distinguish the sexes. The abdominal walls have now closed over in front.

At the third month the embryo is two or two and a half inches long and weighs about one ounce. The amniotic fluid is very abundant so that the embryo floats very freely; the umbilical cord begins to be twisted; the pupillary membrane over the eye is formed; and the limitation of the placenta is distinct.

At the end of the fourth month the embryo becomes the foetus. It is then four to five inches long and weighs five ounces. The muscles begin to contract and thus cause the mother to "feel life" (the movements of the child). The eyes, mouth and nose are formed, but closed. The gall bladder is just developed. The bones of the head are still widely separated.

At the fifth month the foetus is from nine to twelve inches long and weighs from five to nine ounces. Hairs

begin to appear on the head; the liver begins to secrete bile and meconium appears in the intestine.

At the sixth month the foetus is from eleven to fourteen inches long and weighs from one and a half to two pounds. The bones of the head are ossified but the sutures are wide. Plate XXI shows the appearance of the foetus at six months. It nearly fills the cavity of the amnion, and in this instance the umbilical cord has become wound around the neck. If delivered at this time it might live for a few minutes. The midwives speak of the amnion as "the bag of waters." If a child is born with this membrane over its face it is said to have been born with a veil or caul. Superstitious persons like to preserve the caul as it is said to keep its owner from drowning.

At the seventh month the foetus is fourteen to fifteen inches long and weighs two to three pounds. The hairs are longer and darker; the amniotic fluid is lessened so that the foetus cannot move so freely. If born now the foetus might live, if skillfully cared for.

At the eighth month the foetus is from fifteen to sixteen inches long and weighs from three to four pounds. The eyelids are open and the cornea is transparent; the left testicle has descended; the umbilicus is at about the middle of the body; the relative size of the lower extremities is increased.

At the ninth month the foetus is about seventeen inches long and weighs five or six pounds. Both testes have usually descended into the scrotum although communicating freely with the abdominal cavity.

At birth, the tenth month, the infant weighs on an average seven and a half pounds, although very large

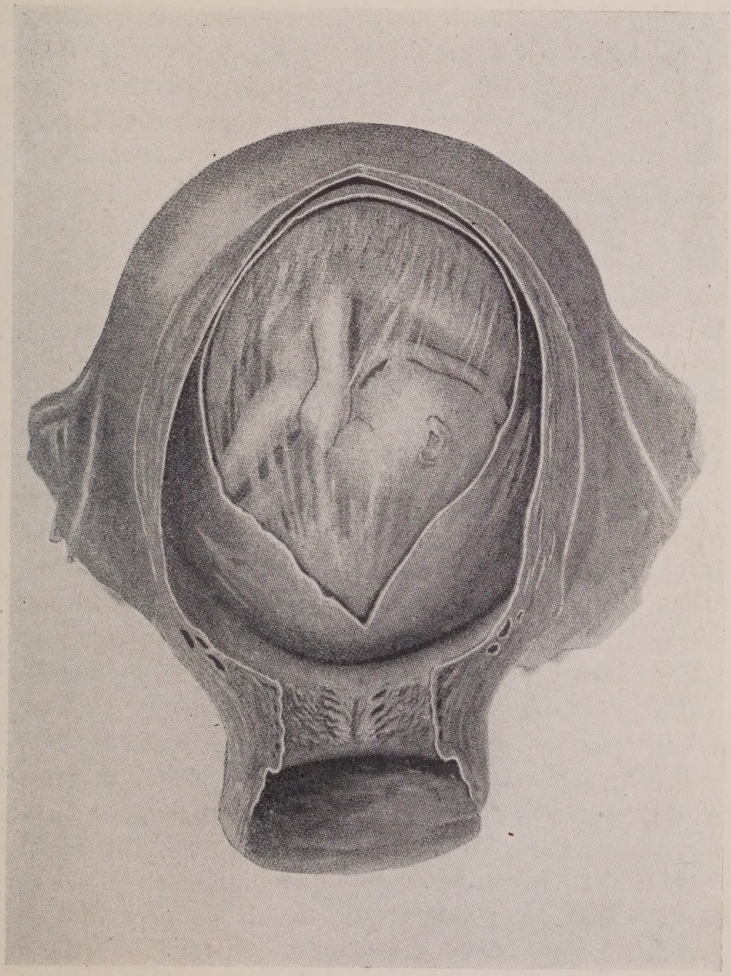

Plate XXI. Child in the uterus at about six months.
After DeLee. Courtesy of W. B. Saunders Co.

women sometime give birth to a child weighing ten or even twelve pounds. It frequently happens that large children are born with less difficulty than small ones. Other factors that influence delivery of the child are the age of the mother, her general build, her strength and health during and before pregnancy, the rigidity of her bony structure, etc.

Plate XXII gives a semi-diagrammatic picture of the child at or near the time of birth. The arms and legs are folded to economize space, the head is nearly always down, owing to its weight; the placenta is clearly shown with the umbilical cord by which nourishment is carried from mother to child. When the child is born the cord is torn or cut off and with the first cry of the child its lungs fill with air after which independent circulation is established through its own heart and lungs. The placenta is delivered a few minutes later and is commonly called the "afterbirth."

The circulation of the blood in the foetus during its stay in the womb is very different from that after birth, and is too interesting to be passed by without remark. While dwelling within the mother the child gets all its nourishment through the placenta attached to the parent. As there is no exposure there is no loss of heat, and as there is very little exercise or motion there is no great exhaustion of tissue. As the lungs are not used until after arrival in the open air, only a little blood is required to be sent to the lungs. Most of that seemingly intended for them is diverted by a duct into that large blood vessel, the aorta. The duct that conveys it across is the ductus arteriosus. The

oval opening of communication between the auricles is likewise needed only so long as the lungs are not in service. With the birth of the child a new miracle is wrought at its first cry. Coming into the open air causes the infant to gasp and cry, thereby filling the lungs with air. The extra blood pressure in the auricles causes the Eustachian valve to close the oval opening (foramen ovale). Should it not close, the blood of arteries and veins would mix and the result be a "blue baby."

When the child leaves the mother the cord leading to the placenta is broken or cut and the new comer is thrown on its own resources. The blood at once ceases to flow through the vessels that constituted the cord. It therefore dries in a few days and forms a scar in the abdominal wall called the navel, or "belly-button" according to the children who wonder what it is for.

We have now traced, imperfectly it is true, the source of the ovum through a period of two hundred and seventy-five days, beginning as a spark of life only one twenty-five hundredth of an inch in diameter and arriving at the weight of seven or eight pounds—an epitome of man. Here we leave him for the present.

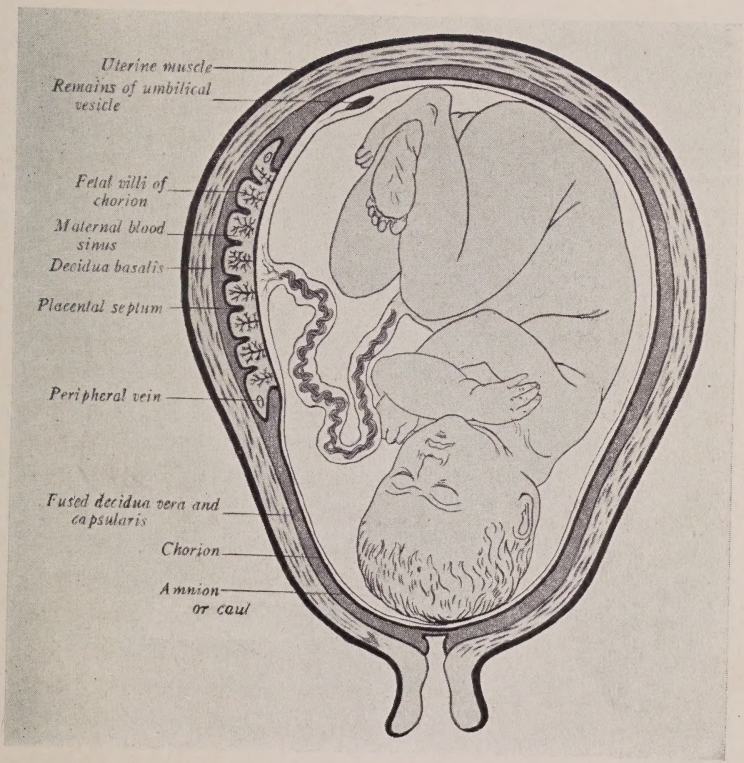

Plate XXII. Section of the uterus showing the relation of the placenta to mother and child. Prentiss-Arey after Ahlfeld. Courtesy of W. B. Saunders Co.

PUBERTY

Puberty is that period in life when the sex organs have developed so that generation and reproduction are possible. Such a condition is, in temperate climates, reached in males at fourteen to sixteen years of age and with girls about two years earlier. Maturity comes much earlier in hot climates than in cold, and is earlier to city-bred than to country-bred youth; luxurious living tends to earlier maturity than does hard work. Maturity in this sense means not that the individual is in all respects an adult but that seed forms in the male and that eggs are formed in the female. There is continual growth of mind and body in both sexes. The period of development, the rounding out of form and maturing of mental equipment, is continued for several years, and is called the period of adolescence. Adolescence means to grow up; and it includes the years up to twenty in the female, and to twenty-five in the male.

Until puberty is reached the individual is counted a child and in all civilized countries is safeguarded as to health and morals by laws. For example, the United States does not allow a child in government employ under fourteen years of age; children between fourteen and fifteen years can be employed only eight hours a day, etc.

According to old Roman law a boy at fifteen years was considered to be of military age and was held

responsible for crime, as for instance, for rape. In civil law in the United States, sex maturity bears no relation to legal coming of age, legal majority being arbitrarily set at twenty-one years. In a few states females attain majority at eighteen years of age.

Growth is in progress from birth, yes, even before birth. The teeth for example, are beginning to be formed in the gum seven months before birth; but they do not burst through, are not "cut," until about seven months after the child is born; in like manner the genitals may be recognized as present at about the third month of the embryo, although the sexes male and female can then scarcely be distinguished. At birth the boy may be easily told from the girl although the external and internal organs are in each case very small and incomplete for the functions they will ultimately exercise. After birth the next important event is getting the temporary teeth, six of which appear before the first year is completed. The next period of active growth is at the sixth year, when nearly all of the teeth are in the jaws, although we see only one set. The milk teeth are gradually pushed out by the growing permanent set. They come through gradually until all have appeared somewhere between the eighteenth and the twenty-fifth years of age. During these same years the skeleton is increasing in height and solidity, the girl and boy showing little real difference until near the pubescent period. The growth of school children has been studied with great thoroughness in hundreds of thousands of instances. Girls are found to out-strip the boys in growth between the ages of ten and fifteen years, the pre-pubertal age;

and then the boys are found to have the most active growth from about sixteen years of age.

The changes noticeable at this period of life are many. To begin with the boy; his muscles grow larger and firmer and he takes up more vigorous games or is capable of harder work than before; there is increased growth of hair and that in new regions—the beard (which the youth discovers before the family can see it), hair under the arms and about the genitals, upon the legs and on some young men very thick on much of the body. The larynx increases in actual length, depth and width so that the vocal chords are much lengthened and the voice becomes deeper in tone, and for some time is likely to crack and break to the lad's chagrin. By degrees the boy gains control of the laryngeal muscles and becomes proud of his deep voice. The larynx projects in the neck forming the Adam's apple. The testes that were very small and rather soft little glands, now become firm bodies weighing nearly an ounce each, of ovoid shape with smooth sides, the left one being a little heavier than the right and consequently hanging lower than its fellow; at the back border is attached the cord which suspends the gland and secures its connection with the organs inside the body. The cord, called the spermatic cord, is made up of the sperm duct, through which the sperms are carried from the testes back into the body, the vessels which convey blood to and from the gland, and the nerve supply.

The changes being wrought in the young girl are more marked and perhaps are more wonderful. She puts on additional fat so that her form is more grace-

ful; the curve, that line of beauty, becomes evident in all her bearing; her chest appears to be deeper than in girlhood and really does deepen for she will increase her chest capacity by 500 cubic centimeters within a year. A boy's increase of circumference at this period is usually abdominal. With the increase of bust measure is included the development of the breasts, now coming to three or four inches across and building up with gland tissue that in the event of motherhood may be called upon to produce milk. The breasts are very tender, likewise the nipples that normally project from them; neither should be compressed by ill-fitting clothing or corsets. In times past many women suffered from inverted nipples because of the supposed claims of Dame Fashion. Just at present corsets are worn so low that the physician wastes words in an attempt to argue on undue pressure. Another evil arises, however, in that there is hygienic and moral danger that the maiden may become careless in exposure of her person to the weather and to the gaze of passers by. Both dangers should be guarded against.

As the chest is widened and deepened, so is the pelvis, the bones forming a broad basin to hold the marvelous organs of maternity and make room for the exit of offspring. The flaring sides of the pelvic bones in a mature woman are ten and a half inches across and the bowl shape within at the brim is about five inches. The male pelvis is much narrower, the bones thick and heavy, and the angle of outlet under the pubes is only 75–80 degrees, whereas the female has and needs an angle of 90 to 100 degrees. The wide pelvis explains the swinging walk of woman as com-

pared with man, her thighs not seeming to hang straight. Considerable fat is formed in the buttocks and thighs of woman, more than in those of man, so that from puberty onward woman tends to present lines and curves of grace, whereas man shows lines of strength, each designed for their special functions in life. The external genitals undergo marked change and are protected above by a considerable growth of hair as in the male. Hair appears in the axillae (under the arms) but scarcely at all on the woman's body. The hair of the head becomes rich and heavy and is woman's pride.

> "In troth thy hair is of an excellent color since I saw it. O those bright tresses, like to threads of gold."

The character of hair has been a basis for race classification. See Huxley, Haeckel, *et al.*

The voice of the girl undergoes changes as does that of the boy, but not of so marked a character. The female voice is high in pitch and soft, while that of the male is low and powerful, each a departure from the childish treble.

The essential changes from girlhood to womanhood occur in the organs within the body, especially in the ovaries and uterus. The ovaries enlarge and give off an ovum each month as described on page 67. With this ripening there occurs congestion of the uterus and a shedding of its lining membranes with more or less bloody flow for three or four days. This occurring each month is spoken of as the menses or menstruation, or the periods, or being unwell, or as Rachel said when sitting on the stolen images, "The manner of women is upon me."

In young women of abounding health this physiological process occurs with scarcely any effect upon the system. These few days however are a trial to many young and older, and the time is one when unusual stress of walking, dancing, swimming and like labors should be interdicted and a rest be had. Young men should realize that there are times when their sisters and friends may from other cause than mere whim and caprice, decline to engage in exercise.

In childhood the aims are selfish for the most part, children always wish to get something or have something done for them; after puberty the idea is to be somebody and do something, especially for the race present or to come. The changes of body and function are not less interesting than those of the mind and character.

Puberty has been known to appear at very early ages in both boys and girls. Dr. T. M. Madden gives authentic cases in his article in Keating's *Cyclopaedia of Diseases of Children*. "In the year 1748, Mr. Dawkes, a surgeon at St. Ives, near Huntingdon published a small tract, called Prodigium Willinghamense, or an account of a surprising boy who was buried at Willingham, near Cambridge, upon whom he wrote the following epitaph:

> "Stop, traveller, and wondering know, here buried lie the remains of Thomas, son of Thomas and Margaret Hall, who, not one year old, had the signs of manhood; not three, was almost four feet high; endued with uncommon strength, a just proportion of parts, and a stupendous voice; before six he died, as it were, of an advanced age. He was born at this village, October 31,

> 1741, and in the same departed this life, Sept. 3, 1747."

See also, *Phil. Trans.*, 1744–45. As Dr. Elliotson has observed, this perfectly authentic case removes all doubts respecting the boy at Salamis mentioned by Pliny (*Hist. Nat.*, lib. VII, c. 17) as being four feet high and having reached puberty when only three years old, and respecting the man seen by Craterus, the brother of Antigonus (cited in *Blumenbach's Physiology*, 4th edition, p. 535), who in seven years was an infant, a youth, an adult, a father, an old man, and a corpse!

As illustrating extreme lateness of puberty and appearance of menstruation, Dr. Madden says:

> "In several instances I have observed the first appearance of the catamenia in persons upwards of twenty years, and in one of them this function was not established until the marriage of the patient in her twenty-sixth year, nor did she then again menstruate until after her confinement in the following year, from which time she menstruated regularly."

These examples will suffice to show how wide a range physiology sometimes covers in establishing maturity.

Precocious sexual development as it indicates abnormal or diseased conditions is to be deplored and will probably mean imbecility, or maybe an early death. Precocious mentality is more interesting and far from abhorrent; for instance, the musical ability of Mozart who played the clavichord and composed music at the age of four years; or Lord Macaulay, who

had a most precocious mind, reading volumes at three years of age, writing a universal history at seven years, at ten years composing poems, hymns and ballads, and in later life gaining a prodigious amount of knowledge. Macaulay lived to fifty-nine years notwithstanding the rule that prodigies die young, as the good are said to do.

Nature is exacting and does not often endow an individual with unusual gifts without demanding compensation or penalty.

The changing outlook of the youth in the "teens" is a study of greatest interest to the psychologist but of the most importance to the parent and teacher. G. Stanley Hall calls this the golden age and surely it is. The youth is passing from the materialism of childhood, through the optimism of adolescence to the realism of manhood and womanhood. The youth has a heart increasing very rapidly in size and pumping power (twenty per cent in a year as against six per cent in childhood) which means a strong active circulation of the rich blood of young life. Because of this, all the bodily functions are in full vigor and naturally the mind is alert to multitudes of new thoughts and ideas. The adolescent sees new beauty in the heavens, the flowers, the sea and all that is therein; there is new music in the woods and fields and in nature generally; the youth of artistic temperament now gets marvelous inspiration from classical music; the girls "just adore" some great actor, artist or performer, a great preacher or writer; they write poetry and revel in romantic novels; a new goal is set—love, fame, wealth, position all loom up on a rosy and golden

horizon. Yes, the "adolescent years mark the golden age of sense, which is so prone to become sensual if uncontrolled." This is the age that seeks excitement in stress of activities of every kind, the restless age. The early to bed and early to rise program gives place to late hours, late suppers, late sleeping in the best hours of the morning, while the body is struggling to remake itself into something newer and greater than ever before.

Seitz is right in saying, "It must also be remembered that *the physiological sexual development is a critical period, requiring much insight and consideration from parents and teachers.*" The emphasis is well deserved. The adolescent is at a critical juncture; a multitude of adjectives are needed to describe his changing moods; he is unstable, emotional, easily pleased and as easily takes offense, he exaggerates an injury and also exaggerates the brilliant possibilities that he sees beckoning him to greatness; the ego is pretty sure to be exaggerated. Because of the consciousness that he has entered upon the period of self importance and independence he is likely to place less value upon parental authority and advice, become arrogant, perhaps obstinate, hypercritical, "knows it all." This is a time when religious awakening occurs, with questioning about the realities of present and future.

Youth is greedy for knowledge of all kinds and this is the time for wise parents to see that information concerning sex and self are given correctly if unfortunately they have not been given throughout the child's life. It can no longer be put off because now sex impulses begin to assert themselves. The boy

that did for a time despise girls begins to take note of them and soon discovers that one of them is wholly different from the others and much superior. In time he may find several others, but the judgment is correct for the present. This discovery of the value of another personality is one of the saving graces of our lives and makes us pity the person who fails to find another soul to share his joys and divide his sorrows.

"Sex ought to be endlessly studied because it is the most endless of subjects" (Schleiermacher). If it is a mystery to the youth he is bound to make inquiries and will very likely find the readiest answers given by those least qualified to enlighten. The morbid and unmoral in sex will be easily forthcoming while the pure and ennobling, the divine and sublime, may be unappreciated. More in detail will be found in the chapters on Purity, Habits and Marriage.

The importance of puberty is recognized by primitive people as well as by the highly civilized. When the American Indian boy reaches puberty there are most elaborate rites with great ceremonies and dances. This is the time when the Australian youths both male and female receive the rites of initiation and the scars belonging to their tribe. In old Rome the boy would have his hair cut and a lock thrown into the fire as an offering to Apollo, and another thrown into the water as an oblation to Neptune; the girls offered their dolls to Venus, and the lockets (bullae) that the children wore about the neck would be dedicated, that of the boy to Hercules, that of the girl to Juno. When the Jewish boy is 13 years old he celebrates the Bar Mitzvah, he is a Son of the Commandment, he reads in

Hebrew and discusses the Talmud in the Tabernacle, and afterward entertains his relatives and friends with a feast. Years of discretion are now assumed to have arrived and Lutheran and English churches confirm the youths who had been baptized previously. This takes place between thirteen and sixteen years for the Lutheran and between fourteen and eighteen years for the English church.

The ecclesiastics instruct the youth in his duty and regarding his conduct in general with reference to the laws of society. Deportment is learned from the dancing master, the jeweler tells the maiden how to care for her wrist watch, the automobile agent instructs her in the mechanism of her new high-power car: But who shall explain the workings of the mechanisms of marriage and maternity? Who will tell the youth where his impulses and needs correspond and where they are at variance? Shall the information come from the blasé young man of questionable morals? Shall the fast girl who already has "a past" instruct the innocent and pure?

Sex impulses do dominate our lives in more ways than we like to admit at times, but they may impel us to the highest and best there is in life just as surely as, if allowed, they will drag us down. Let parents, teachers, and physicians improve their opportunities helpfully to advise and where necessary to admonish the youth of our land that are soon to be the fathers, mothers, law-makers and valued citizens of our country. To *help* such persons is the purpose of this book.

The choice of books for adolescents is important, for that matter the reading should be properly super-

vised from childhood up. Young persons are fond of fiction and especially of the romantic sort. The wisdom of parents and teachers is needed to suggest such as hold the mirror up to nature in a proper manner and do not emphasize unfit types or morbid characters.

The following are all of high order: *David Copperfield*—Dickens; *Ivanhoe*—Scott; *John Halifax, Gentleman*—Miss Mulock; *Vanity Fair*—Thackeray; *Lorna Doone*—Blackmore, for Scotland; all of these are counted among the best of the older novels. In our own land there are novels representing life in all parts of the country, for example, *The Kentucky Cardinal*—Allen, and *Colonel Carter of Cartersville*—Smith, about the South; *Romona*—Jackson; *The Blazed Trial*—White; *The Log of a Cowboy*—Adam, for the West; *Oldtown Folks*—Stowe; and *Elsie Venner*—Holmes, for New England.

Sea lovers would want *The Seiners* by Connelly, and *Westward Ho!* by Kingsley. The romantic temperaments would want *Notre Dame de Paris*—Hugo; *Charles O'Malley* by Lever; *To Have and to Hold*—Johnston; *Saracinesca, Sant Ilario* and *Mr. Isaacs*, by Crawford.

Those who are inclined to be studious should read Dr. Eliot's Five-Foot Library. Every one should give some stated amount of time to the best poets, beginning of course with Shakespeare. Then there is the beautiful story of *Evangeline* by Longfellow, *The Lady of the Lake* by Scott, the poems of Tennyson, Alfred Noyes, Stevenson and many others from all lands. A complete list of choice books would involve copying the catalogue of a good modern library which is beyond

the scope of this work. We do want, however, to insist that no one should allow himself or herself to be idle. There are more books of value than any one person can read under usual conditions. Select with care and read with diligence the life of one or more notable persons each year, for biographies are most helpful in character building.

TERMINOLOGY, DEFINITIONS

It would be surprising to one not a physician to hear what strange and foggy ideas even adults have concerning the subject of sex. It is in part because the young in particular have not a proper vocabulary, and hesitate to ask questions of the well-informed that they seem more likely to talk with the ignorant or vicious. The less intelligent among us realize that the vernacular is not always polite. A few remarks may, therefore, be made aside from the glossary to be found at the end of the book.

The commonest term for the coming together of the sexes is coitus, from the Latin word *coitio*, a meeting; another word used by zoölogists and other students to indicate sexual intercourse is copulation, also from the Latin, *copulatio*, meaning the act of coupling or connecting. The grammarians use the word copulative conjunction for the word that joins phrases; the origin is the same. Congress or commerce is sometimes used, from *congressus*, a close union. Conjugal relation is derived from *conjungere*, to join in marriage; connubial and nuptial from *nupta*, a bride, a wife.

Some of the terms and phrases used have special legal value; for example, marital affection refers to marriage to a wife, as distinguished in Roman law from a mistress or concubine, in relation to property rights.

The seventh commandment is familiar to young and old, but its legal definition would have to be answered

by lawyers in each of the states because the commonwealths have varying statutes. Some of the United States hold that adultery is a crime if the woman be married, others if the man be married. The old Jewish and Roman law counted the case one of criminal adultery if a married woman cohabited with a man other than her husband. The possibility of alien offspring being thus brought into a family is the probable cause of the very severe penalty that was formerly visited upon the offenders, fine and imprisonment in England and even death in Scotland. In Europe illicit intercourse is counted adultery on the part of a married person and fornication for the unmarried.

Unfaithfulness to the marriage vows is now a cause for civil action in the courts, with the right to demand dissolution of the marriage by divorce. By fornication so much mentioned in the Bible is usually meant sexual intercourse between unmarried persons, although the word is often used figuratively as, "it is from the heart that come evil thoughts, adulteries, fornications," etc. Matthew XV, 19.

HABITS

Habits of all kinds are begun and formed very early in life, in fact very much of what we do, not to mention what we think, is the result of habit. In infancy the little child investigates everything that it can reach and touch. It is as natural for it to handle the genitals, a practice that horrifies some parents and does not enough disturb others, as it is to pull its fingers or toes. If the practice is persisted in it indicates that there is an irritation of some kind requiring relief; it may be an adherent foreskin in the boy or adherent clitoris in the wee girl; in either case the adhesions should be broken, and then cold cream or some soothing ointment should be applied. Mothers and nurses should from the beginning see that perfect cleanliness is maintained about these sensitive parts. As children grow older and take their own baths they should be trained to as perfect cleanliness of the "uncomely parts" as they exercise regarding their teeth and ears.

When young boys get near the period of puberty the increasing size and sensations in the genital organs draw their attention definitely to these, which not a few try to exercise in unnatural ways; immature organs are thus taxed before they are ready for functioning and the boy finds himself given not to self-exercise but to self-abuse. Self-abuse, masturbation, onanism, self-pollution, whatever the term of description used, is an evil that should be overcome and surpressed at

the earliest evidence of indulgence in it. The effect upon the growing lad is physiologically bad, but especially is it detrimental to his mentality and relation to companions. This secret vice is an act of selfish gratification that indicates a lack of self-control, of self-respect, and of self-appreciation. The habit established becomes as hard to correct, if not more difficult to conquer, than the liquor or opium habit. This miserable misuse of special organs intended for special purposes is merely robbing the future.

A young man soon finds the quack and charlatan interested in his "loss of manhood" and assures him that he will become insane, etc. This is not true, but it is a fact that the insane and imbecile spend much time in the filthy ways in proportion to their lack of shame and sense.

Girls are not so apt to fall into solitary vices as are boys, though it is more common than many parents believe. The remedies are the same for either sex; abundance of healthy exercise, plenty of cold bathing with special attention to local cleanliness, encouragement to companionship, team play, base ball, basket-ball, tennis, swimming, skating, to all manner of out-door and in-door athletics in season, a hard bed to sleep on, and general hygiene. Of special value is the cold bath immediately on awakening in the morning. The diet should be ample in quantity, simple in quality and without high seasoning; stimulants and spices are wrong for the young, whatever they may be for middle-aged or old people. Attention should be given to the bowels, an action of which should be expected every morning. A furnace with a full ash pan cannot be

expected to give heat, no more can the human system carry on its work properly if wastes are not removed. Moreover there is absorption of poisons from effete matters left negligently in the living organism, a detriment which the mere inanimate heater is spared. If it is not practicable for all young people to indulge in active sports and pastimes, the less vigorous persons may be organized into parties to study botany, birds or wild life out of doors, to collect geological specimens, or just to "hike" across country. Any excuse to be out in the open, will do. Matinee and opera parties have no value as remedies in sex troubles. The Basuto chief says "To do good is like rolling a rock to the top of a mountain; as for the evil, it comes about of itself; the rock finds it easy to roll to the bottom." (Mackenzie, *An African Trail*). Yes, evil comes about very easily. Threats will have little effect, warnings will do no good as cures for the afflicted youth; appeals to self-respect, to the sense of honor and manliness, to chivalry and family pride will have a more helpful influence.

Encourage the crowd in youth, discourage retirement and solitude.

Plate XXIII. The Family Circle
Courtesy *The Ladies' Home Journal.*

MARRIAGE

"Of all the fabrics of society marriage is the most complicated, the most delicate, and the most significant." *Ellen Key.*

"And he who gives a child a home
Builds palaces in Kingdom come,
And she who gives a baby birth
Brings Savior Christ again to Earth,
For life is joy, and mind is fruit,
And body's precious earth and root."

John Masefield.

"Society must be relieved by sound instruction of the horrible doctrine that the begetting and bearing of children are in the slightest degree sinful or foul processes. That doctrine lies at the root of the feeling of shame in connection with these processes and the desire for secrecy. The plain fact is that there is nothing so sacred and propitious on earth as the bringing of another normal child into the world in marriage. There is nothing staining or defiling about it, and therefore there is no need for shame or secrecy, but only for pride and joy. This doctrine should be part of the instruction given to all young people." *President Emeritus Charles William Eliot* of Harvard University.

Marriage is a subject sure to engross the attention of all normal young persons. They will consider the likelihood of their own marriage or speculate as to why their friends entered such bondage, or whether or not

there be any state comparable to that of holy matrimony, etc.

> "Love that inspires our noblest poems and is celebrated in our greatest music, that builds Christian homes and makes family life beautiful, is a primal impulse trained and elevated, become intelligent, disciplined and consecrated." *Fosdick.*

> "Marriage is an engagement entered into by mutual consent, and has for its end the propagation of the species," says Hume.

The history of marriage, its many forms in different ages and among various races, is a subject full of interest. The early and simple people had customs varying with their needs and civilization.

Families require support and therefore the young man was expected to give evidence of his ability as a provider before he was allowed to take a wife. The young man of the Yukon had to kill a deer, but the youth of the Zambesi brought down a rhinoceros.

Marriage has always been regarded as normal and necessary; among the Mohammedans as a duty, and among the Hebrews as a religious duty. In Egypt it was considered disreputable not to marry. The Fijians even believed that he who died wifeless was stopped by the god Nangganangga on the road to Paradise, and smashed to atoms.

Before civilization had advanced far, tribes lived in groups, and fought off robbers and rival hunters. This resulted in many instances in the powerful taking the weaker people, especially the young women as

wives or concubines. Bible students will recall that Moses sent his hosts to conquer the Midianites, and that they divided the spoils, flocks, herds, great quantities of metals, and thirty-two thousand virgins. (Numbers, Chapter 31).

Purchase of wives was a very old practice. It implied that the women in a family were property and could be bargained for. As an example, the Turcoman gives five camels for a young girl to wife, and will give fifty camels for a well preserved widow because she is experienced. (Howard). We do not need to flatter ourselves much on having advanced beyond such practices. John Marshall tells us that the men who settled Virginia found it a very fertile land and they planned to amass wealth and return to England. "To put an end to a mode of thinking so ruinous to the country it was proposed to send out one hundred maids, as wives for the colonists. Ninety girls, young and uncorrupt, were transported in the beginning of the year 1620, and sixty more in the subsequent year. They were immediately disposed of to the young planters. The price of a wife was estimated first at one hundred, and afterwards at one hundred and fifty pounds of tobacco, then selling at three shilling per pound, and a debt so contracted was made of greater dignity than any other." (Marshall's *Life of Washington*, 1804.)

While wives are no longer openly paid for, it is common for large amounts of money or securities to be settled upon one person before marriage to another, for example, a wealthy American heiress to a titled European lord.

In primitive times women and children worked because there was little of hired labor. Under the present labor conditions it is usual to work for wages, and both men and women are regularly employed outside their own household or family.

In early days a man having a numerous family was counted wealthy because the wives and children could work for him. The more workers, the more possessions. Speaking of Makalolo women, Livingstone observes, "On hearing that a man in England could marry but one wife, several ladies exclaimed that they would not like to live in such a country; they could not imagine how English ladies could relish such a custom, for in their way of thinking, every man of respectability should have a number of wives, as proof of his wealth." (Westermarck.)

As evolution of the family has progressed it has become evident that woman enjoys more privileges and is most respected where there is but one wife. Monogamy has become the rule. To be sure Mohammedans permit polygamy, yet only about five per cent of them have a plurality of wives. Four is the number regularly allowed.

> "Marriage—when it is a marriage at all—is only the seal which marks the vowed transition of temporary into untiring service, and of fitful into eternal love." *Ruskin.*

Marriage embraces more than physical love, it involves constant companionship, mutual respect as well as affection, a losing of self-interest in a devotion of husband to wife, or of wife to husband. The man

and woman that were two individuals become not only one flesh, but one in sympathy and aim, and when blessed with children, blend their lives in love and sacrifice for their offspring.

The intimate physical relations of husband and wife lend to an ecstacy of sense, naturally, but to those who are ideally wedded there is added such a harmonious spiritual union that two souls do indeed become one.

Marriage naturally implies motherhood. What a marvelous word is MOTHER. The small boy boasts of his mother's deeds and ability, the young soldier is inspired in the trenches by memories of his mother, the mature man honors his aged mother. There is no nobler word in any language than MOTHER.

In the usual course of events the perfect home contains children. The ancient Jews repudiated the barren wife, and the Mormons even now deny the childless wife a place in heaven.

How interesting and fascinating are the maidens, the innocent young girls, the college graduating class for example. How absorbing is the story of Joan of Arc and that of other heroines. But after all, it is the Madonnas, the Mothers, that call forth our highest admiration and love. The young mother with her first born at her breast is a picture of joy and accomplishment that will fill anyone with wonder and approbation.

It will be readily admitted that there is need of coöperation of the sexes in reproducing the species, but it is often forgotten that there is equal or greater need of coöperative sympathy, unselfishness and affection, if there is to be a perfect home atmosphere;

a house is not a home; a home in the true sense is "that rallying-place of the affections" where every member of the family circle does his utmost to make this particular hearth the happiest in the world.

In making a plea for high ideals and a spiritual basis for the marriage state, we do not assert that there should be no consummation except with the expectation that a child result; love and affection of themselves are sufficient warrant for heeding the desires of sex. Nevertheless, as great joys are never won without great denials, a proper sense of loyalty and devotion should lead to temperance in this sphere of action quite as much as in other departments of life. Intercourse may be indulged in once or twice a week by persons in perfect health and accord, although the weak or nervous had better recall Tristram Shandy, and come together but once a month. A perfectly normal function of life should be allowed to become neither a nervous tax on the system, nor an act debasing to those concerned. A man should never allow a woman, especially his wife, to become a slave to his desires alone; marriage is a mutual compact in which the obligation of noble conduct, "noblesse obligé," should always prevail. The larger conception of life and its responsibilities should, with married people, supplant selfish ends, and in the phrase of Foerster, "their energy be yoked to higher purposes."

It not infrequently happens that a young woman falls in love and comes to the bridal chamber not realizing the urgency and desire of her chosen husband and protector. If such a young woman realized that there is a definite physical side to marriage, and if all

husbands were experts in gentleness and kindness, the world would be spared many tragedies.

It is not strange that some persons are slow in adjusting their lives to that of their consorts. It is not politics nor the suffrage that breaks up homes so much as lack of ideals and occupation in home and family development. The man whose only thought is business, and the woman whose only interest is pleasure, cannot be expected to make a perfect home nor to rear a family worthy of pride. Women are now taking a very active part in the business world; under the circumstances this is entirely proper; but there are always women without the motherly and home instinct who declare that they will not be "tied down" by family cares, forgetting that the family blessings will more than compensate later.

"Maternity diminishes neither the energy nor the intellectual faculties of women. Nay, it acts in an undeniable manner upon the virtues necessary for a proper operation of human society. It expands the feelings of altruism and kindness, the most beautiful flower of social life, and, if the services rendered by woman as mother constitute her worthy of all the privileges and all the honors which man has annexed, the beauties of soul which she acquires in the accomplishment of this change make at the same time this enlargement of feminine rights desirable and beneficial for both sexes." *Finot.*

Of the writers on marriage and kindred subjects, Ellen Key is one of the most forceful. While we cannot subscribe to all of her teachings, we may approve of much that she says and get good from extracts from

her books. "Real fidelity can only arise when love and marriage become equivalent terms." "Purely sensuous unions may in nine cases out of ten deteriorate both the man and the woman,"—to which may be added that they who rise to nothing higher, never experience a love which is creative in its fullest sense. They may be said to have sterility of soul. This author has given us a new word, "erotoplastics: the doctrine of love as a consciously formative art, instead of a blind instinct of procreation." That will engage the attention of those who are interested in eugenics, the science of making the race better.

Again a fine sentence, "In motherliness, humanity has attained what is at present its most perfect form of life within the race taken as a whole," and "Motherhood is a natural balance between the happiness of the individual and the whole, between self-assertion and self-devotion, between sensuousness and soulfulness." She expresses the hope that "men and women will dedicate to their mental and bodily fitness for the mission of the race the same religious earnestness that Christians devote to the salvation of their souls."

Among the Germans no one is better able to speak on marriage than is Goethe, the prince of poets, student of nature, of man, and of philosophy. His observations of life in the eighteenth century are equally applicable to the twentieth. Foerster quotes from his "Wahlverwandtschaften" as follows:

> "Marriage is the beginning and summit of all civilization. It makes the rough gentle, and it affords the most refined the best opportunity for proving their quality. It must be indissoluble, for it brings so much

> happiness that all unhappiness sinks by comparison into the background. . . . Human life is so built up of sorrows and joys that it is impossible to know how much a husband and wife may owe one another; it is an interminable debt which can only be paid in eternity. Inconvenient it may sometimes be, that I grant, and rightly so. But we are not wedded to our conscience, which we would often be rid of, for it is more inconvenient than ever husband or wife could be."

The perfect evolution of love depends upon harmony of purpose and action, therefore happiness involves mutual sacrifice and devotion. Love cannot thrive where there is an atmosphere of slavish service or lordly domination of spirit.

Marriage is a sublime relationship—"The same passion that makes debauchees and criminals fills with sanctity the lives of thousands of men."

As marriage is a combination of two human lives, it is sometimes found that human frailties develop and instead of bliss disunion results. This is not difficult to understand, because lust is not love, and passion is far from patience, and desire different from devotion. True love does not end in ecstacy of sense but in the perfect blending of two personalities. True love calls for patience in the uneven paths of life, for sympathy in the sorrows sure to come as well as the sharing of joys and successes. When these qualities fail, separation and divorce are likely to follow.

The Roman Catholic Church counts divorce a sin, hence few of that faith dissolve the marriage contract. Exclusive of members of that church, the census of 1916 showed that there were granted in the United

States 112 divorces to 100,000 population and that marriages in the same year were 1050 per 100,000 population. One marriage in every nine was terminated by divorce. The divorce evil is a real one, but aside from our present discussion, twenty-five divorces to ten thousand couples does not seem so great as do the total figures for the entire country.

Most of the divorces are asked for by the woman. The causes include alcoholism, childlessness, desertion, cruelty and in twenty per cent of instances, adultery.

If the so-called "lords of creation" were less solicitous about their marital rights and more thoughtful of the marriage vow "to love and cherish" there would be fewer wives seeking separation.

HEREDITY

The subject of heredity is of two-fold interest to us: first, because of what we inherit, that is what we fall heir to; and secondly, because of the sort of body and manner of characteristics that we are going to transmit to our children.

According to the dictionary, Heredity is from the Latin *hereditas*, signifying heirship. It is the subject of the transmission of physical characters and mental traits from parent to offspring. In plant life there are the physical factors only, while in the animals there are psychical characters as well. Man rightly prides himself upon mental qualities, superior to those of any other member of the animal kingdom.

The inheritance of a farm is easily understood: the former owner dies and leaves it to the heirs or to whomever he may *will* it in a document properly drawn and signed. Not so simple is bodily heredity or genius of any kind. A parent cannot of his own volition transmit to his son his skill as an artist or to his daughter his ability as a pianist. Inheritance is from both parents, although apparently not always in equal proportions. The new individual is bound to be composed of cells both paternal and maternal which will divide and subdivide indefinitely, always with a part of the nucleus as well as of the body of the cell. The nucleus, it is to be remembered contains the chromosomes, the color bodies, which are believed to be most important as they

carry the characteristics of the parent to the child. A parent may have acquired a great amount of knowledge or peculiar skill in some art, he may have gone into battle and lost an arm; these acquired conditions are not transmitted directly to the offspring, but a tendency, a trend toward, a possibility of the same acquirements may be handed down. It is facetiously remarked that wooden legs are not inheritable, but Keetley used to tell us that the same military spirit that inspired the father to go to war, where he might lose a leg, would be transmitted to the son, who would likewise go into battle and might come home on an artificial peg. If the professor of mathematics has a son, the lad will have to study hard to come up to the level of his sire, but the son will no doubt, because of his heredity, acquire his "math" more rapidly than some of his mates.

Heredity receives credit often when it is not fully entitled to it, but should be made to share with environment, that is, surroundings. For example, the supposed son of the professor is in a home where study is a habit and where accuracy of speech and thought prevail, so that he, from his surroundings, becomes a student.

Heredity in a general sense is understood to imply the same characters in succeeding generations. Hence the common sayings, "Like breeds like," "Like father, like son," "A chip of the old block," and so on through the list.

Many features may be manifested definitely in certain families, for example, the color of the hair very red, very black, sometimes white; or, unusually heavy hair, or decidedly curly hair. The color of the eyes,

with at times a peculiar speck or mark, will be found to prevail in some families, while there will be wholly different shades in other groups. Now and then persons have an extra finger or toe, or maybe webbed fingers and toes, as a family trait. Albinism, the lack of pigment in hair, skin, and eyes, is also a hereditary characteristic. It occurs in birds and animals as well as all races of men. It is very noticeable in the Negro of either sex. The writer has seen Albinos among black-birds, sparrows, and crows; also in the Negro. It is so common in rabbits, cats and sometimes dogs that it occasions little comment.

It used to be common to speak of diseases as being inherited; for example, tuberculosis, Bright's disease, rheumatism, etc. We now know that the number of diseases that can be transmitted directly from the blood of the mother to the child, is very small indeed. It is true, however, that we do inherit from our parents a constitution or body that is peculiarly liable to be of the right sort for the development of certain ailments. A parent with tuberculosis (consumption) does not transmit it to the offspring as yet unborn, but the children about the house may contract it because of the close association of the members of the family. In recent years, as there has been a campaign waged that makes everyone aware of the dangers of this plague and of how successfully it can be cured, the theory of direct hereditary transmission has been about abandoned.

One of the greatest students of heredity in modern times was Charles Darwin (1809–1882), whose *Origin of Species* brought forward a new theory or an old theory with new force of the evolution of the species

and "The Descent of Man." Darwin maintained that while the offspring inherit the characters of the parents there are changes brought about by surroundings and the natural selection of the fittest in any given case. For example, birds, such as the ostrich, that ran much would develop great power in the legs and by disuse find the wings of little account; thus the giraffe by constantly feeding upon the tender twigs of trees would develop a long neck.

This theory of the evolving of animals and of the descent of man was at variance with the literal interpretation of the account of creation as given in the book of Genesis and therefore aroused a spirit of resentment in many minds, although the book of Genesis is not a scientific treatise. As time passed it was found that natural selection, although of great importance and value in development, would not explain the origin of new species that do undoubtedly arise occasionally. At times there appear definite and sudden changes in the offpring of plants and animals, termed by de Vries, mutations (Latin, mutatio, change), or "sports." Such mutations will breed true and thus form a new species. In this manner are produced various plants or fruits and flowers by the horticulturist; so also the Japanese have developed the extraordinary fins on some gold fish or the telescope eyes, freaks at first, but definitely bred later. The many kinds of pigeons are all derived from the same plain wild bird; likewise the great variety of dogs are descendants of the wolf.

Burbank, the California wizard, has succeeded in producing many flowers and fruits by artificial selection

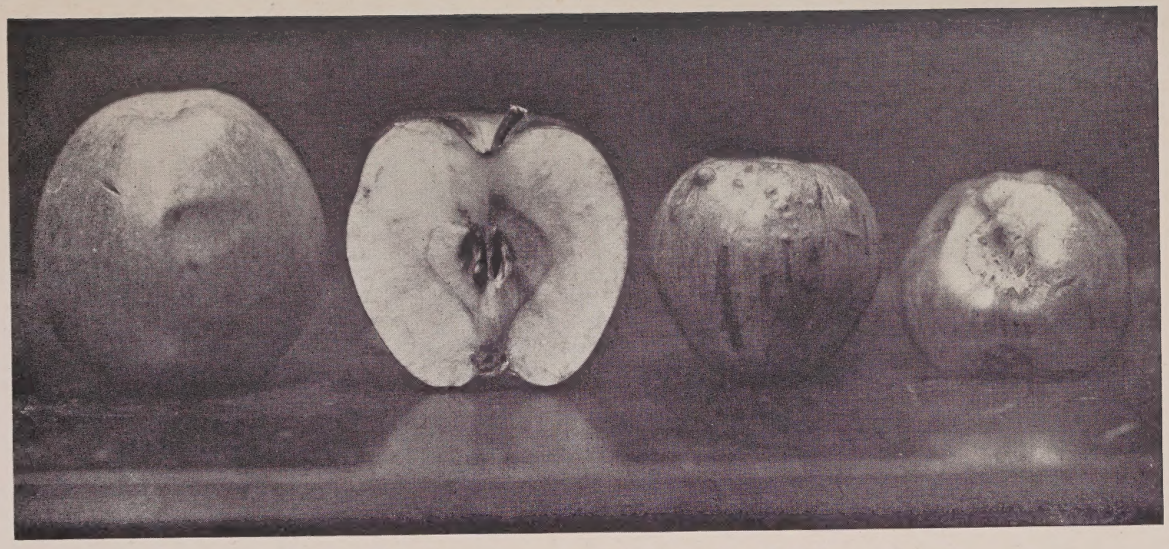

Plate XXIV. Illustrating selection and accidents of environment.

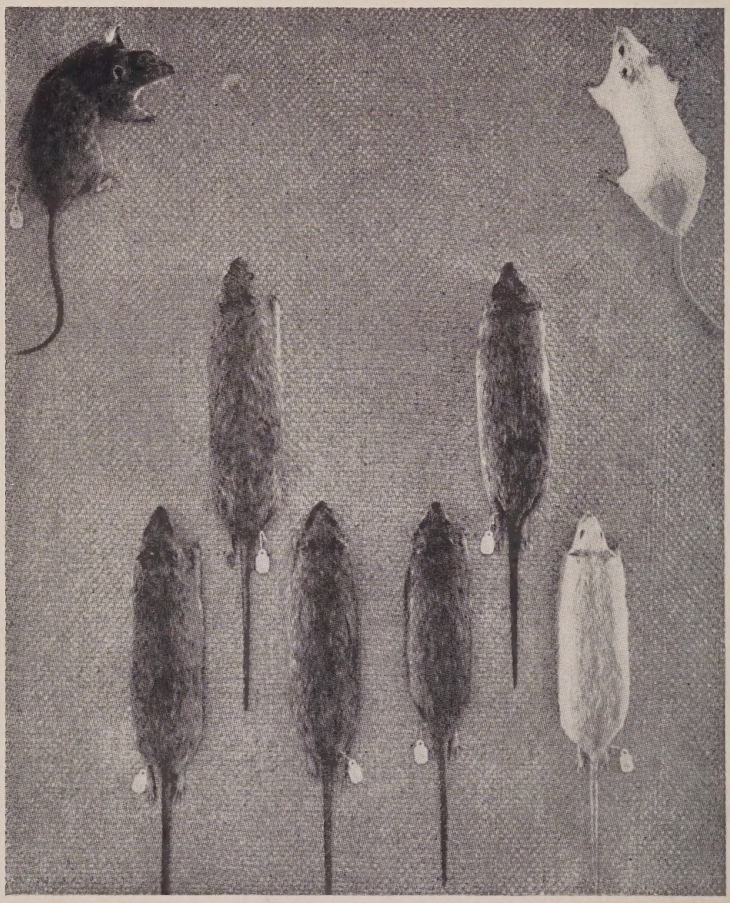

Plate XXV. Mendelism in Rats

If a pure gray rat be mated with a white rat the offspring will all be gray, for gray is dominant and white is recessive. In the next generation there will be three grays to one white; the white and one of the grays are pure and will breed true; the other two grays are hybrids. Courtesy American Museum of Natural History.

and cross breeding, though the crossing must be of the same species. By this means he has given us the plumcot, a cross between the plum and apricot; by selection he has produced a cactus without spines and potatoes having an enormous yield. Plate XXIV may serve to impress upon the youth the value of artificial selection. Any student would of course select for his luncheon a large fine apple instead of a small gnarled one. The fruit grower would be sure to choose the finest specimens from which to secure seed. The gnarly apples suffered in outward surroundings if not in nourishment. Blight has deformed one and insects have stung the other so that each is fit only for the cider mill. Very little moralizing ought to be sufficient to convince a young person of the value of choosing only the best of companions and the best possible environment. If this sort of choice prevailed in society as well as with the nursery-men, there would be fewer cases of friendship ripening into "disastrous love" and fewer tragedies in the home nursery. The breeding of various strains of cattle, horses, and other farm animals is familiar to every one fortunate enough to have had any country experience. The humorist has suggested grafting the queen bee on the Plymouth Rock hen and thus increasing her egg producing power from one hundred and twenty per season to one hundred and twenty thousand per season. The only result is amusement, as different species cannot be crossed.

The results of inheritance have been studied by many persons, notably by the monk Gregor Mendel (1822–1884).

MENDEL'S LAW

Mendel was a student of plants as well as of piety; he spent much time in experimenting by cross fertilizing peas and noting the regularity with which certain characters appeared in succeeding generations. He found that if tall peas were crossed with dwarf peas, the second generation of hybrids would contain tall and short in the proportion of three tall to one dwarf. As tallness was in excess so constantly it seemed to dominate over the character of dwarfness; therefore tallness is said to be *dominant* and dwarfness to be *recessive;* these terms are descriptive and used regularly in describing the processes of heredity. Just as in a group of boys there will be one who dominates over the others, so there are dominating factors in heredity, as black over red in the color of cattle, curly over smooth in the hair of guinea-pigs, a plain comb over a rose comb in cocks, and so on ad infinitum. Mendel's Law, therefore is, that special characteristics are handed down from parent to offspring in definite ratio.

Plate XXV, illustrates clearly mendelism in rats as shown in the exhibit in the American Museum of Natural History. One is pure white, and one pure gray, the remaining two being hybrids or blended. The pure gray or the pure white rats if mated with their own kind would breed true, but not so the hybrids.

Plate XXVI illustrates most beautifully additional

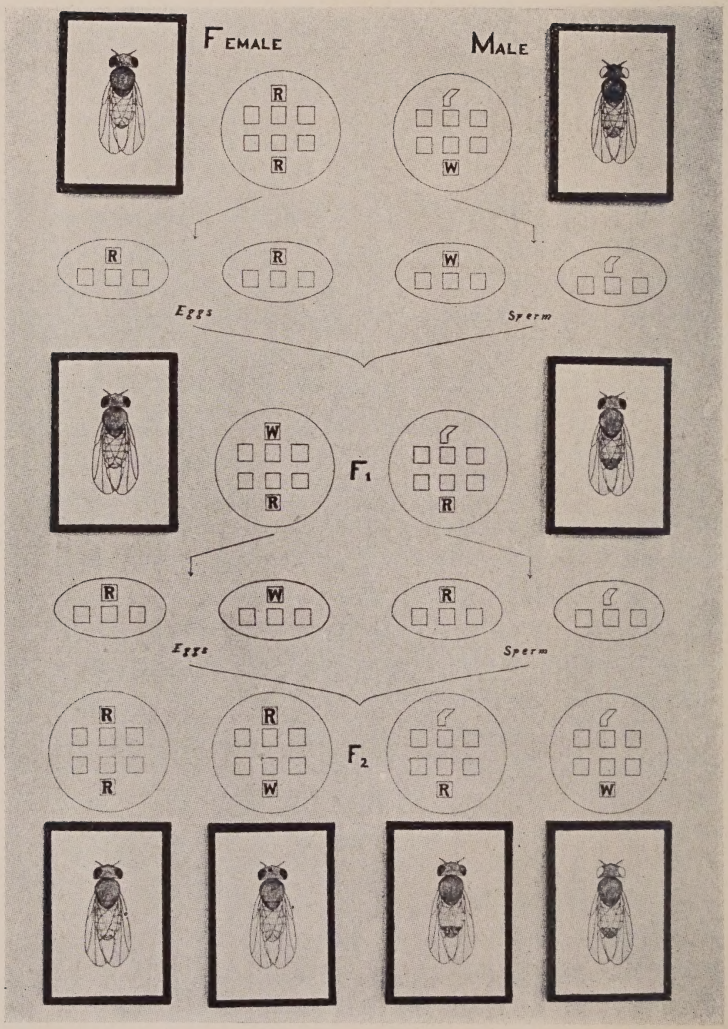

Plate XXVI. Sex-linked Inheritance

White eye color in the pomice fly is one of a number of characters which are sex-linked. The diagram represents the chromosomes of the pomice fly, circles referring to body cells and ovals to germ cells. The sex chromosomes are shown above and below the ordinary chromosomes, the factor for eye color which each one carries being indicated by an initial. The odd shaped figure is the "Y" chromosome. When this is present the individual is a male. Courtesy American Museum of Natural History.

characters and sex. There is some factor that determines the sex in animals and it is spoken of as the "Y" chromosome. It is called the determiner. Its presence insures the individual being a male. The figure represents the pomice fly that flourishes on asparagus; it shows in diagram and picture how the white eye and the red eye, as well as sex features, are transmitted.

Sweet peas illustrate very well the phases and colors of flowers. The color in flowers is due to two factors or elements, one of which is presumed to be a ferment, and the other a "chromogen," that is, a color producer. Two white flowers having differently shaped pollen grains were crossed with the result that they produced not white blooms, but red and purple. The explanation is that the two flowers contained elements that were latent when alone, but when united in the new plant produced colored blossoms like their wild ancestors from Sicily. The new flower, named Purple Invincible, by self-fertilization produced all the remaining varieties shown. In this instance red and purple are dominant over white, white being recessive. Either form of white if left to itself and self fertilization would continue to throw white blooms.

> "Heredity is simply the sum of all the effects of all the environments of past generations" and "upon crossing of species—wisely directed and accompanied by a rigid selection of the best and as rigid exclusion of the poorest, rests our hope of progress." Burbank.

We are not responsible for what we inherit, but are accountable for the manner in which we improve or

abuse our heritage. This being true, we should be especially careful regarding factors known to be transmissible in the human family. No presentation could be clearer than that of the Kallikak family, given by Goddard.

The name Kallikak is fictitious but the history of the man and his family was ascertained with great care for nine generations back. The young man came of a good stock with no taint of nervous infirmity whatever. He became the father of a son by a feeble-minded girl. The descendants of this son have been traced to the number of four hundred and eighty. Of that number one hundred and forty-three are feeble-minded and sixty others morally or physically defective. Later the young man first mentioned married a worthy Quaker lady by whom he had children; the descendants of this union number four hundred and ninety-six, none of whom are mentally defective. Figure 9 exhibits this family history very graphically. The squares indicate men, and the circles represent women; N, stands for normal mind, and F, stands for feeble-mind.

The diagram points its own moral. The laws of heredity are fixed if not immutable. Evil characteristics are often passed on, but the laws operate equally for the good. Blood will tell; "blue blood" counts.

As an example of fine breeding and great attainments there is none better than the history of the Edwards family; beginning in this country in 1640 and continuing to the present day, including many notable names of men and women, judges, authors and three United States presidents.

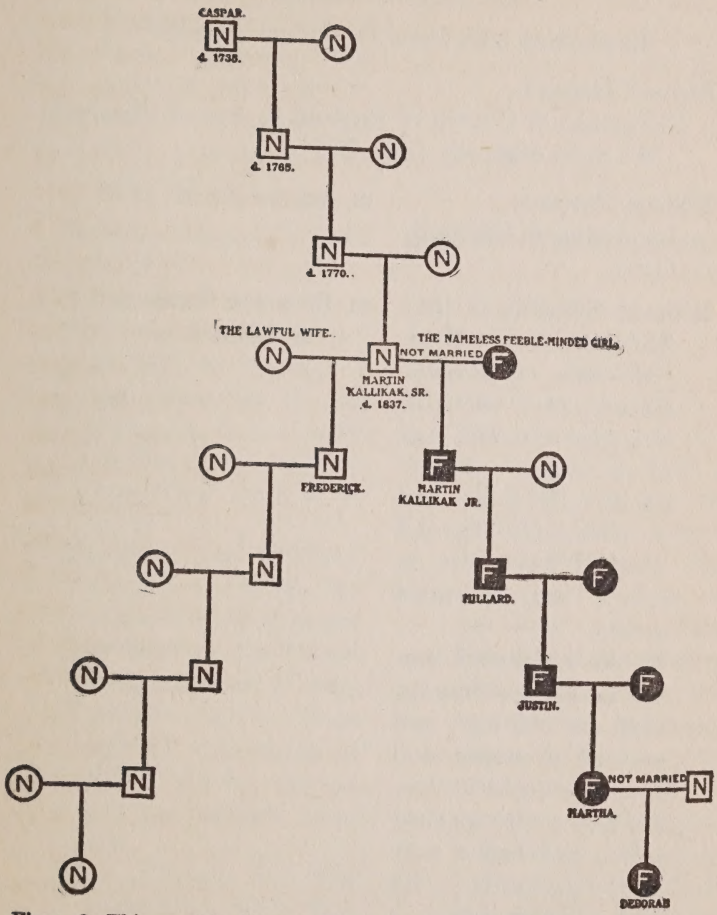

Figure 9. This graphic diagram illustrates the fact that feeblemindedness may be inherited. N, stands for normal; F, stands for feebleminded. Observe the presence of feebleminded persons in every generation on the right. On the left are indicated the descendants of the lawful wife, all are normal. From *The Kallikak Family*, Goddard. By permission of The Macmillan Company.

"The Edwards Family"

Illustrating both heredity and environment.

Richard Edwards
Clergyman of Church of England in time of Elizabeth.
He came originally from Wales.

William Edwards — m Agnes Spencer, 1645
Landowner in Hartford, Conn.

Richard Edwards, b. 1647 — m Elizabeth Tuttle
Merchant in Hartford. 7 children
"He was of a noble stature, of a straight, well-formed body, and of a comely countenance. His smile had a pleasantry beyond which I have seen in many, yea, in most others.
He was quick and nimble in his movements, even to old age; and was of a strong and healthy constitution. He had a strong, clear mind, and had a very good utterance. He had a quick fancy; a pleasant, ready wit, with a very good judgment. He would argue in a matter and reason in a case very well. He

was a man of considerable reading; both in Law, History, and Divinity; was well furnished for society, and very pleasant in consultation."

Timothy Edwards, b. 1669, d. 1758
Clergyman.
Graduated from Harvard in 1691, at 22 years of age "receiving the degree of A. B. and A. M. on the same day—'an uncommon mark of respect.'"
Pastor at East Windsor, Conn., where he remained sixty-four years.
Appointed by the Colonial Legislature of Connecticut as the Chaplain of the troops of that State for the expedition against Canada.
"Mr. Edwards was well acquainted with Hebrew Literature, and was regarded as a man of more than usual learning, but was particularly distinguished

m Esther Stoddard, b. 1671, d. 1770.
11 children
Second child of Rev. Solomon Stoddard of Northampton, Mass.
"Timothy Edwards died on January 27, 1758, in his 89th year, and the sixtieth of his ministry; Mrs. Edwards died January 19, 1770, in her 99th year. Mrs. Edwards is described as 'Tall, dignified and commanding in appearance, affable and gentle in her manner, and was regarded as surpassing her husband in native vigor of understanding. Remarkable judgment and prudence, extensive information, thorough knowledge of the Scriptures and of theology, singular conscientious-

for his accurate knowledge of the Greek and Roman classics. He annually prepared a number of youths for college, there being at that time no public schools or academies endowed for that purpose. One of my aged informants, who pursued his preparatory studies under him, told me that, on his admission into college, when the officers learned with whom he had studied, they remarked to him that there was no need of examining Mr. Edwards' scholars."

(From Mr. Timothy Edwards' grandson, Rev. Sereno Dwight).

ness and piety,—these are virtues attributed to the mother which reappear in her son Jonathan. These also came as if by natural descent to a daughter of Solomon Stoddard." Jonathan Edwards, in a letter, says: "My grandfather Stoddard was a very great man, of strong powers of mind, of great grace and great authority, of a masterly countenance, speech and behavior."

Johnathan 1703–1758 married Sarah Pierpont 11 children

President Princeton College for thirty-four days where he died of smallpox. At twelve years of age he wrote an account of his observations on spiders, and also his conclusions, concerning the soul. He graduated at Yale 1720 in his seventeenth year. He early came to have "an inward sweet delight in God" and became the greatest theologian of his day. He was precocious in his youth and independent in

maturity. Fiske called him "one of the wonders of the world." In 1750 he became missionary to the Housatonnuck Indians, at Stockbridge. This fact accounts for the proficiency of himself and family in Indian affairs and language.

Jerusha 1730–1747	Betrothed to David Brainerd, the missionary.
Esther 1732–1758	Married Rev. Aaron Burr, President of New Jersey College. Mother of Aaron Burr, Vice President of the United States.
Mary 1734–1807	Married Timothy Dwight. Their son Timothy was president of Yale College. Two other descendants, each of whom become President of Yale College, were: Timothy Dwight, 2nd and Theodore Dwight Woolsey.
Timothy 1738–1813	Judge of Probate Court, Berkshire, Mass. He had fifteen children.
Johnathan, Jr. 1745–1801	President of Union College. Greatest Indian scholar of his day, partly due to his having lived among the Indians from his sixth year. He was a great reasoner, and in many ways like his renowned father.
Pierpont 1750–1826	Judge United States District Court, Connecticut. Member of Congress. Thought in Indian language.
	Son, Henry, 1779–1847, Governor of Connecticut. Son, Ogden, 1781–1862, Judge of Supreme Court.

Of the descendants of Jonathan Edwards much has been written; a brief catalogue must suffice; Jonathan Edwards, Jr., president of Union College; Timothy Dwight, president of Yale; Sereno Edwards Dwight, president of Hamilton College; Theodore Dwight Woolsey, for twenty-five years president of Yale College; Sarah, wife of Tapping Reeve, founder of Litchfield Law School, herself no mean lawyer; Daniel Tyler, a general in the Civil War and founder of the iron industries in North Alabama; Timothy Dwight, second, president of Yale University from 1886 to 1898; Theodore William Dwight, founder and for thirty-three years warden of Columbia Law School; Henrietta Frances, wife of Eli Whitney, inventor of the cotton gin, who burning the midnight oil by the side of her ingenious husband, helped him to his enduring fame; Merrill Edwards Gates, president of Amherst College; Catherine Maria Sedgwick of graceful pen; Charles Sedgwick Minot, authority on biology and embryology in the Harvard Medical School; Edith Kermit Carow, wife of Theodore Roosevelt; and Winston Churchill, the author." To this list should be added the name of George Woolsey, Professor of Surgery in Cornell Medical College.

"Of the daughters of Elizabeth Tuttle distinguished descendants also came: Robert Treat Paine, signer of the Declaration of Independence; Chief Justice of the United States Morrison R. Waite; Ulysses S. Grant and Grover Cleveland, presidents of the United States. These and many other prominent men and women can trace the characters which enabled them to occupy the positions of culture and learning they held back to

Elizabeth Tuttle." Ellery Sedgwick, editor of *The Atlantic Monthly*, Henry Dwight Sedgwick the well-known essayist, and Theodore Sedgwick, Rector of Calvary Episcopal Church, New York, are entitled to places on this list.

Genealogy of the Edwards Family, by Wm. H. Edwards.
Appleton's *Cyclopædia of American Biography*.
From Davenport's *Heredity in Relation to Eugenics*.
Hunter's *Civic Biology*.

EUGENICS

Eugenics is the science pertaining to improvement of offspring.

Eugenics is practically heredity under control. It is the subject that should naturally engage our attention after discussing transmission of traits. The breeders of cattle and hogs, and the raisers of cotton and corn, study their subject and get ample advice from the government. The farmers' bulletins number about six hundred, yet none contain advice on raising man, although he is of far greater value to the state than flax or timber. What will the ship of state be made of if there are no thinking men? The feeble-minded breed readily, law or no law, and are undisturbed by statutes. The bearing and rearing of children is one of the most wonderful responsibilities permitted to man, and therefore should be under the control of persons of intelligence of mind and health of body.

New York City, realizing these facts, created a Division of Child Hygiene in its Health Department in 1908. Four years later Congress established the Children's Bureau of the United States Department of Labor. These agencies are actively engaged in supervising whatever will be of advantage to babies even before birth, to infants from birth to school age, and then with reference to study and later, work.

Each bureau sends out literature and lecturers and may be addressed for information concerning infant

mortality and child saving. It is to be hoped that they will soon be as well known as the Department of Agriculture and as useful.

A man by taking thought cannot add a cubit to his stature, but he may add to that of his child, or perhaps make an effort to eliminate some factor that he does not wish to see passed along. Birth control is a serious subject and one to which discerning people should give consideration. Why are the ignorant and poor allowed large families while those with better heredity and superior surroundings fail to bear an average share? Johnson found that ninety per cent of women marry before they reach forty years of age, but only forty-five per cent of college women so marry. It has been found that a Harvard graduate has three-quarters of a son and that a Vassar graduate has only half a daughter. This ought not so to be.

"We cannot countenance a theory which deliberately leaves maternity to the less intellectual. In addition to the clever mother's contribution to the organic inheritance of the child, there is the hardly less important nurtural influence in the home. The idea of leaving maternity to a docile and domesticated type, of cow-like placidity, while the intellectuals run the world, is quaintly non-biological." (Geddes and Thomson). It may be that the "high-brows" are naturally sterile, surely many appear to be; but there should be developed a pride in descendants equal at all events to that of ancestral pride. Prizes are given in many cities for the best babies brought to babies' clinics and making the most gain in weight under the advice of social welfare nurse and physician; this is all most commendable, and

shows attempts at and success in overcoming unfavorable environment. Many persons are fond of aping the nobility. Let them copy Queen Victoria, who was noted for every domestic virtue and reared (and nursed) four sons and five daughters that have obtained for the royal family of England the respect and admiration of the civilized world." William II of Germany had seven children, six of whom are sons; a picture of an Emperor with six military officer-sons surely attracts attention. In our own land we are not without noblemen, for example Theodore Roosevelt, with his interesting family of six children, four of them sons who were officers in the recent world war and of whom Quentin the youngest, an aviator, made the supreme sacrifice in France.

In the seventeenth century in England births were taxed; the birth of a duke £30 ($150.) that of a common person 2s. One would almost suppose that people in good circumstances think this tax still in force.

In all countries the birth rate has steadily fallen during recent years. For example, England in 1871 had a birth rate of 35 per thousand population, but in 1915 the rate for England and Wales was 24.9 per thousand population. Wars make havoc with birth statistics, for the armies are composed chiefly of healthy young men who would in conditions of peace be home makers. During the four weeks at the end of 1917 and beginning of 1918 the birth rate of five large cities in Great Britain fell to 17.60, and that of five large cities of Germany fell to 8.8 per thousand population. Wars are political in origin but have very marked biological results. Wars are in a way emergency measures and

are not responsible for the conditions existing in the home during times of peace. Who is responsible?

A propaganda is being carried on with reference to informing the poor and ignorant of the manner and need of limiting the number of children; as this class is very prolific it becomes as much a matter of economics and health as a question of morals and law.

If the ignorant and indigent are to be advised not to have so many children as they now have, the wise and flourishing should be more strongly counseled to see that their next generation is of as fine stock as they think themselves to be.

Professor Conklin suggests that the prize student at college should marry the prize athlete; good advice biologically and socially. Professor Adolf Meyer declares that "It is in the interest of civilization to provide principles and customs rather than laws, and to give the plain sense of the individual a chance to develop and become effective." In accordance with that idea the doctor then puts forth this proposal for the marriage ceremony. "Why not replace the much discussed question of obedience by the question, put to both parties to the life contract: Do you want this man (or this woman) and no other to be the father (or mother) of your children?" Such a measure would be unusual, but would tend to make young and older persons realize that marriage is a means of perpetuating the race and is not a mere casual union to be set at naught by a divorce writ on the slightest provocation.

There are many evidences that eugenics is a subject for public consideration as well as of private concern. For example, the meetings of The Summer School of

Civics and Eugenics held in Oxford, England. The two subjects are closely related, perhaps more so than some of us had thought. It would be of great advantage to the future if similar schools were organized in this country.

> "The essence of all education is self-discovery and self-control. When education helps an individual to discover his own powers and limitations and shows him how to get out of his heredity its largest and best possibilities it will fulfil its real function; when children are taught not merely to know things but to know themselves, not merely how to do things but how to compel themselves to do things, they may be said to be really educated." Concklin.

All of this we indorse especially as to sex education in old or young people. Self knowledge and self-mastery are at the beginning, after which with increased information and experience, may come the ability to help instruct other persons.

Those who hope to have ideal children to share in the ideal home life, must heed a few biological laws; for instance, a man having a definite family history of tuberculosis should not marry a partner with the same history, for if both parents have a given trait it will most surely be transmitted to offspring, whereas if one only carries it the chances are that it may be bred out. The same is true of persons in whom there is a history of mental aberation in any degree, of insanity, or feeble-mindedness, epilepsy, etc. Some readers may not be pleased at the use of such definite terms, but "Breed 'in' to fix type; breed 'out' to secure vigor" is just as true among lords and ladies as among our

domestic pets. A woman should know that if she marries a man with bad ancestry she is in danger of bearing a child with the characteristics of that family, just as she is in danger of contracting and transmitting disease if the husband suffers from an inheritable malady. The affections and romanticism play so large a part in the matter of marriage that the laws of nature are frequently ignored entirely. Nature is inexorable and while retribution must be made where there has been wrong doing, virtue no less certainly has its rewards. Since crooked minds arise from crippled brains let us see to it that so far as possible no damaged citizens are allowed to become parents.

Eugenics among people is in the nature of the case very largely negative. Elements are more easily left out than introduced into the family. Realizing the instability of slightly feeble-minded persons, morons, as they are technically termed, certain states set aside institutions for segregating them from the normal public charges. Some states have gone farther and made laws that permit of the sterilization of criminals and feeble-minded folk. This is easily accomplished in the male by vasectomy, that is cutting out or through the vas deferans, the tube that conveys the sperm cells. In the female, removal of the ovaries, ovariotomy, destroys the egg-producing power and hence the individual is rendered barren. See Plate XIX, page 96.

Society is not suffering much (except in expense) from the unfit in institutions but is affected by those who are at large in every community. Let those who are interested in practical eugenics see to it that no unfavorable strains get into the next generation.

Thus far we have laid stress upon heredity and said little about environment. The scholars are always ready to argue as to which is the more important factor in life, heredity or environment; whether nature or nurture is of greater value.

The stock from which we sprang is dominant; but the surroundings into which we landed also have very great importance. The writer remembers three colored boys of the same age, who were being brought up in the same mission school, each from a different race, a Hottentot, a Bushman, and a Negro from our own city of Washington. These youngsters seemed to be almost as much alike as brothers when they played or studied together.

Heredity is a powerful factor with us all; however there are too many persons ready to accept the philosophy of the colored brother in Dunbar's *Accountability* from which we quote a few lines: [1]

"Folks ain't got no right to censuah othah folks about dey habits;

* * * * * * *

We is all constructed diff'ent, d'ain't no two of us de same;
We cain't he'p ouah likes an' dislikes, ef we'se bad we ain't to blame.
Ef we'se good, we need n't show off, case you bet it ain't ouah doin'
We gits into su'ttain channels dat we jes' cain't he'p pu'suin.'

When you come to think about, how it's all planned out it's splendid.
Nothin's done or evah happens, 'dout hit's sumefin' dat's intended;

[1] Lyrics of Lowly Life. Dodd, Mead and Company.

Don't keer whut you does, you has to, an' hit sholy beats de dickens,—
Viney, go put on de kittle, I got one o' mastah's chickens."

We inherit by the germ cells a certain type of mind and temperament, but being endowed with wills, our responsibility increases with our years. Experience and our mental faculties should enable us to regulate our actions if not our thoughts, to choose our environment and associates. Young persons should be especially impressed with the need of putting themselves in the path of helpful currents and cautioned to avoid drifting toward whirlpools.

We cannot leave all to heredity, by any means. All men contain latent powers of heroism, leadership, sacrifice, or ability in some art or science; few of these characters come out automatically, instead the individual must train himself and be constantly alert and ready to respond to the environment and its needs. There are many persons who have well appointed homes and can provide wonderful environment for children, but who for some cause have none of their own. Those who have not been blessed by children may be a source of great good to the children of other parents. There are many orphans who would be glad to be adopted into childless homes and who would be a credit to the new home makers. We have seen them and know whereof we speak.

PURITY

Chastity brings to the mind figures of purity, spotlessness, pure white marble, the driven snow, the purity of the Easter lily with which we opened our book, etc.; in the realm of life it means a character without blemish, one who is innocent of unlawful intercourse with the opposite sex, is morally pure, as a virgin.

Why should such a subject come up for discussion or treatment, even in a book of this character? Because established physiological facts have been variously interpreted by various people in different ages. Laws of conduct observed by some persons are disregarded by others with the plausible assertion that laws of nature must be heeded.

We learned earlier in our study that when the adolescent period is reached there comes a new set of feelings and the congestion of organs that aforetime did not attract the attention of the possessor? The young person for instance may awaken to an urgency of sex consciousness or desire that with some temperaments causes a sense of anxiety as to moral depravity; to another there may be feelings of a purely animal sort; while the third, being a well balanced individual in mind and body, realizes that here is a physiological condition to be respected, but not to be allowed to become master. In times past there were many men who believed or feigned to believe that all strong sex

desires must be answered by intercourse with the opposite sex, in order to maintain health of body, whether there was moral health or not. In the countries and at the times when such views prevailed, it was abundantly demonstrated that the custom was selfish and unsafe. Promiscuity of relations leads to diseases spread by such lax moral and physical acts, and more is the pity of it, these diseases do not stop with the original perpetrators, but are carried by married men home to trusting wives or by young men to innocent brides and so to children as yet unborn.

The ardor of youth and lack of moral backbone at times has caused a fall, but it must be acknowledged that it is habitual moral obliquity that has given rise to great trouble in the conscience of some persons, to great expense to society, has caused a sick rate as large as that of tuberculosis, has injured the health of countless thousands of people innocent as well as guilty, has caused blindness to infants recently born, has incapacitated workmen in times of peace, and has caused a loss of labor, and therefore of wages, that is enormous. In times of war venereal diseases have rendered ineffective more men than have shot and shell. In view of these facts we cannot longer pass over a subject largely ignored by the previous generation.

Chastity is no longer treated with derision. It has become generally recognized in recent years not only in this, but in European countries, that there is no physiological need for impure living. Immoral indulgence not only exposes to contagious disease the participants, but may bring permanent injury to those

as yet unborn. Moreover it impairs the ability to appreciate the highest and purest love.

Before going into details of disease we may note the recorded opinions on the subject as given by college presidents, physicians, social investigators, health board officials, and specialists.

> "Purity is being put upon a sound working basis." Howard.
>
> "Continence is in general, increasingly regarded as both feasible and wholesome." Flexner.
>
> "The American Medical Association has repeatedly repudiated the false doctrine that sexual continence is incompatible with health." Wile.
>
> "It is not most virile men that are licentious, but those with weak irritable sex organs." Morrow.
>
> "The most rigid chastity of fancy, heart and body, is physiologically and psychologically—imperative,—nor is it hard if continence is inward, for nature in all healthful bodies brings normal relief." Stanley Hall.
>
> Immorality is very expensive. "Losch for example, has reckoned the annual cost of prostitution to the German Empire as between 300,000,000 and 500,000,000 marks. This outlay may be contrasted with that spent by the Prussian Government on its entire educational system; its universities, secondary schools, elementary school system, technical and educational schools of all kinds involving a budget in 1909 of a little less than 200,000,000 marks." Flexner.

It would be agreeable to continue to think of these diseases due to immorality as being uncommon and occurring in strata of society much below us; but the

war has brought forth some indisputable facts as to the social evil. To begin with, we can felicitate ourselves that the morals of our navy and army are superior to that of any other country. When our sixteen battleships and cruisers made the memorable trip around the world a few years ago the cases of venereal diseases occurring were remarkably low.

According to the Surgeon General's report for 1910 practically one-sixth of the admissions to hospitals were for gonoccocus infection. The admissions for bronchial affections during the same period numbered one-sixth of those for gonorrhea.

The incidence of venereal and all other contagious ills was recorded for the army at all military forts and stations before the draft of 1917. After that date, the call for all men between twenty-one and thirty-one years of age for examination showed the state of health and fitness of all grades of society of the age given. General impressions, correct or erroneous, had to give way to absolute facts which were in part as follows: During the period of four months, from September to December, 1917, the rate of hospital admissions for venereal disease in the Regular Army was 88.0 per thousand men; that of the National Guard, 115.2 per thousand men; and that of the National Army 162.4 per thousand men. Such a state of things existing in civil life is our warrant for speaking frankly for the benefit of the young men and women of our day and generation. This is an age of service, and we are not only, it may be, to serve our country in the trenches but are to serve our community by informing the ignorant and warning the foolish regarding the most

vital relations of society. Warning is not enough, we must encourage all teachers and parents to see that the youth of our land have prophylactic treatment, in other words, have their minds and bodies so busily engaged in study, recreation, exercise and the like, that sex impulses never become dominant.

With this idea in mind the United States Public Health Service has issued W. D. Bulletin No. 1, *Keeping Fit.* It should be circulated freely, especially among young men. It emphasizes strength, will-power, courage, self-control, physical training rules, sex health, relationships with girls and women of the right sort.

"If we are ready to die to protect our homes, we should surely live in such a way as to safeguard them."

DISEASES OF THE SEX ORGANS

There are two diseases common among immoral persons. The first is Gonorrhoea, a catarrhal affection due to a special germ found in the pus cells from anyone suffering from the malady, not from a cold or strain as sometimes claimed. In men, this germ, called Neisser's gonoccocus, causes inflammation of the urethra with soreness, swelling, a discharge, and pain when voiding urine. It frequently happens that the inflammation produces a narrowing of the canal called a stricture, perhaps more than one. The disease may extend to the prostate gland and to the seminal sacs where the germs lie dormant and inactive for years. This explains the infection of innocent wives by husbands who may have harbored the germs for a long time supposing themselves to have been cured. If there be very extensive inflammation of the epididymis sterility results. When gonorrheal germs infect the joints, arthritis of a severe type results. This is also called gonorrhoeal rheumatism.

In women the inflammation attacks the vagina, frequently extends to the womb and tubes and thence to the ovaries. A very large proportion of the surgical operations required upon the sex organs of women can be traced directly to these germs. As in the male, so in the female, sterility may result from the infection. Little girls are often infected in homes or schools where there is ignorance or carelessness in the common use of

toilet articles, wash cloths and the like. Many infants at birth have their eyes infected as they pass through the vagina, the birth canal. As a result they suffer from Baby's Sore Eyes (ophthalmia neonatorum). There are now in the United States ten thousand persons blind because of the gonoccocus. The possibility of the eyes being infected is so well recognized now-a-days that most physicians drop argyrol solution in the eyes of each baby as soon as it is born thus destroying any germs if present.

Syphilis.—Syphilis is a disease with a past, for it was known to the Chinese 2600 years before the Christian era. In the fifteenth century it was a veritable plague owing to the large proportion of the population affected. Much of the leprosy mentioned in Hebrew history is believed to have been syphilis. The Latin word for a spreading epidemic disease was lues (lū'ēz) and that name is now, by many physicians, applied to syphilis. The affection is better understood than it was a hundred years ago, therefore its ravages are somewhat under control; but at the same time it is now recognized that its effects are very far-reaching. The cause is a bacterium found in the blood, *Spirochaeta pallida* by name, that is usually gotten by sexual intercourse, though it is claimed that twenty-five per cent of cases are acquired innocently. This is not at all surprising when it is remembered that the germs are contained in any secretion of the body, especially the saliva; thus infection is easily spread by kissing, by using common drinking cups, towels, unclean cups or spoons at table, swapping candy and pencils at school, and like methods, quite accidental and unobjectionable to the uninformed.

State Health Boards have secured the passage of laws and have adopted ways that have pretty thoroughly dispensed with common drinking cups. This is a measure of protection against all infectious germs.

Where the infection enters the body there will result a sore, on the lips, cheek, or usually about the genitals; at times this may be so slight as to cause annoyance for only a few days or be overlooked. Later there appear various spots and eruptions on the skin that impel the sensible person to consult a physician; later there occurs swelling of the glands, loss of hair, pains in the bones and hard masses form in various organs of the body, even in the brain and spinal cord; in fact it is now known that most cases of paresis (brain softening) and several forms of paralysis are due to this insidious invader. Syphilis after many years of quiet may complicate other diseases. Syphilis doubtless gave origin to the statement "visiting the iniquity of the fathers upon the children, upon the third and upon the fourth generation," because this ailment may be inherited. More than that, it causes the death of many infants before birth and consequently premature delivery (miscarriage, abortion). If born with this poison, the babe soon shows evidence of it in forms of skin trouble, snuffles, bone affections and later the permanent teeth may have a characteristic peg-like form. Fortunately a majority of children inheriting syphilis die young.

The Wassermann reaction of the blood is now counted upon to determine the presence of syphilis and to indicate when it is cured. The introduction of a preparation of arsenic known as Salvarsan has overcome the

germs to such an extent that this plague seems about to be controlled, if not banished.

Public education concerning sex hygiene has advanced remarkably in most of the states. Oregon has cleaned up her vice centers and although her population is only about 600,000, figures a direct saving to the state of $200,000 a year. That state also has a law requiring a health certificate of those intending to marry.

New York, a populous state, has enacted a law "in relation to certain contagious diseases," Chap. 264 of the Revised Statutes, that is far-reaching in its effect upon venereal diseases and the carriers thereof. Well may the State government take action and the City Department of Health also, for New York City has more than five thousand deaths a year from syphilis directly, and nearly five thousand from paresis, which is usually of syphilitic origin.

"Forewarned is forearmed" has been a favorite saying for years and it cannot be better used than in reference to the social evil, the sex immorality that makes havoc with the family, the state and the race in general. If the younger generation can be informed of the danger that may be presented at any time, and of the value of immunity, so to speak, writers and teachers will be well repaid for their labors. Virtue is its own reward, because moral living promotes health, while conversely, impure living often results in disease. Any one knows that impure milk or water may carry the germs of scarlet fever or typhoid fever; impure persons are just as liable to be carriers of venereal germs of one kind or another; moreover some of the germs and their effects do not stop with "the party of

the first part" but are transmitted to the next generation.

Is it a square deal for a man to demand purity in his wife when he may be harboring germs that may blind or blight their offspring? It is time to insist on a single, not a dual standard of morality, chastity only, for both man and woman. Self-command and strong will are elements in character independent of sex. The weak-minded are notably weak in regard to sex matters, have little or no judgment or power of resistance to temptation. A large per cent of prostitutes and immoral women are feeble-minded. Twenty-five years work among these folk in an institution and observation for a much longer period outside, has convinced the writer of the truth of this statement.

There is no reason to limit the term prostitute to the female. Why not call a spade a spade? Roué, rake and debauchee may be more masculine, but convey the same idea.

> "It is safe to say that most men would be none the worse, but all the better for great self-restraint; and this not only in deed and word, but also in thought." Freud.

"There is no pathology in continence" is the simple statement of Féré.

Moral laxity has been often explained if not advocated upon physiological grounds, but this is merely the excuse of those who do not wish to keep within the pale of purity. Physicians and students of social needs throughout the world are now united against such propaganda. The sexual necessity is a myth.

"Those men are safeguarded from unchastity who have learned to think of love and marriage and sexual functioning as interdependent . . . and who feel the impossibility of their personal interest in marriage without love or in sexual union except as expression of deep affection." Bigelow.

The same passion that has, uncontrolled, made libertines of some men, has by conjugal love and good-will been softened and transformed to the perfecting of thousands of other men. The life of both man and woman is a process of evolution, only developing properly under the influence of a permanent union. The advent of children adds responsibility, but cements the affections and ennobles the sex relations.

CHILDREN'S QUESTIONS

Although this entire book has been written to give information, it may be that some reader will want specific answers for the many questions asked by children.

The scientist and the child are continually asking what? and why?

The scientist will be content with nothing less than the truth, and the child should be told nothing but the truth. It is understandable that not all children are ready for the entire truth concerning generation, but so far as they are informed about the reproduction of plants, pets or persons the information should be correct. The day of reciting myths as facts is passing; the stork carrying a baby in a pretty white cloth, and the family physician with his bag supposed to contain a little sister, all make attractive pictures but erroneous impressions.

If man is the supreme animal, why should he be ashamed of his body? Shame may apply to deeds, but cannot be applied to anatomy and to physiology nor to normal physiological processes. The organs of generation should not be thought of as related to impurity, but considered in awe that we by them are enabled to take part in creation. Children cannot comprehend all this at once, although they very quickly take the idea of fatherhood and motherhood in birds and in pets, if it is presented to them frankly and simply.

A very young child will ask about its navel, or dimple or belly-button. He can be told that before he was born he could neither eat nor breathe, so mother's heart supplied him with food through blood vessels that entered the body at that particular place. When he was born that way of getting food ceased, and then the tube dried off leaving the little scar.

Another early question will be "Why does that rooster jump on those hens?" Why not give a correct answer? Say that all birds and animals have a father and a mother, and that each must supply a part of the new individual whether it is a blue-bird, a rabbit, a kitten or a baby boy.

Hens, like all other birds, produce eggs, but the eggs cannot grow to hatch young birds unless the father bird (the cock, the male), provides the sperm cell. The rooster "treads" the hen in order that the sperm cells may pass out of the tube in his body into the tube where the egg of the hen is forming. The egg is then said to be fertilized, and it will develop if it be incubated, that is, kept warm by the mother hen sitting on it, or by being placed in an incubator of proper temperature.

All birds and animals that produce eggs are called females; all birds and animals that produce sperm cells are called males. This is also true of plants and of the human family.

Facts are so largely impersonal to children that they are not abashed by statements that seem lacking in modesty to older persons who have come under the sway of artificial proprieties. Modesty and delicacy are not destroyed by knowledge of one's self nor of kinship to "all ye creatures" about us.

Children are taught to keep clean because it is best for their health; they should be instructed to see that all parts of the body get their due share of attention, and should not neglect the so-called private parts because they happen usually to be out of sight. The sexual organs are of the utmost importance to the coming generation, hence they must be kept from every form of injury or abuse, as much so as the eye or the ear. As the child is taught to keep his mouth clean and not allow food to collect about the teeth, so he should be instructed to see that there is no accumulation under the fore-skin, and the little girl should be advised about the vulva. Cleanliness first, and then hands off.

The subject of contagion is one that cannot be introduced too early. When the contagion of scarlet fever or diphtheria is mentioned, stress should be put upon the need of clean drinking cups and toilet articles for each person; there should be no common towel or wash cloth. This is understood by adults but must be taught to the young of each generation.

The common drinking cup has already been abolished from railway cars and public places, the reason being to avoid contagious diseases so often conveyed by secretions in the mouth. Children sometimes share bites of candy or fruit or borrow pencils that may have been in the mouth of another person, not knowing that disease may be transferred by those least suspecting it. This form of courtesy should be discouraged for syphilis is one of the infections most readily passed along, even by kissing.

One of the commonest of questions is "Where does the baby come from?"

The child knows that baby birds come from eggs in a nest. It has to be explained to them that baby animals that are nursed by the mother, grow in a soft warm place within the mother, remaining in her body until they have grown perfect enough to be born. A satisfactory explanation is that there is an opening in the lower part of the mother's body which at the proper time enlarges enough to permit the little stranger to come to the light, to be brought forth, in other words to be born.

If a new baby is expected in a family the time is ripe to interest the older children. The mother can tell them that she feels the movements of a little one below her heart, where they too may feel it, and be let into the secret that there is special cause for being very thoughtful of mother, and of saving her from worry and over-work. The older children will be delighted to help in preparing for the new comer.

The next question will be "Why does the doctor come?" Answer, because birth is a very serious and painful affair for both mother and infant, and on that account the doctor may need to exercise all his skill to see that no accident happens to either of them. Although the pangs of childbirth may be severe, there is great joy in the household when the travail is completed. All of these statements are rather bald, but the mother of discretion and the teacher of good common sense will surely be able to convey them with a delicacy of manner that will make the proper impression upon the child.

QUESTIONS FOR PARENTS

When children approach the period of puberty they become more self-conscious than they had been, and as they get farther along in adolescence the know-it-all feeling takes possession of them. For this reason they ask few questions unless they are on very familiar terms with father and mother.

Did you the parent foresee this and give instruction of the right kind and amount as your child was growing up? If not, you will be giving advice to a twelve or fourteen year old, just six years too late. Children at eight or nine years of age receive sex information usually, and that from poorly informed if not evil-minded companions.

Have you been anxious about the morals of your neighbor's child and neglected your own son and daughter? Ask your boy if the gang that he goes with are of clean speech, and trying to be manly or whether they are given to obscenity and low talk about girls. Encourage your son to take a firm stand against low language and especially to avoid companions of questionable morals. If he cannot impress his crowd with the advantages of clean speech and a chivalrous attitude toward girls, he should leave it and seek to join a new bunch. The fellows who are too familiar with careless girls, and that indulge in spooning are likely to start impulses in themselves and the girl which may get beyond control. High-school teachers are well aware

of the trouble that pupils get into through ignorance. Have you warned your boy and girl?

Are you telling your older son that the "physiological necessity" is an exploded and proved error? Have you impressed upon him that taking a chance, is inviting disaster? "It is going right that is the big adventure," says C. H. Wilson. It is big things that make a strong appeal to the young man.

The list of contagious diseases may be made a long one: Those that are common to childhood are usually recovered from entirely; the fevers run definite courses and subside. Infections like gonorrhoea and syphilis, however, are far more insidious and frequently remain latent and unobserved for years until transferred to an innocent wife or infant by a man who thought himself cured. Have you explained all this to your family?

Patriotism and loyalty have been much to the fore in the recent war days. Selfishness gave way to sacrifice every where, yet alas, venereal diseases caused more days of inefficiency during the recent war than did wounds. Urge upon your sons that real patriotism is in planning for perfect health in your community and for the next generation children without blemish.

SUMMARY

Positive results can be accomplished only by positive effort; therefore the currents of energy and virility that are causing a young person to drift toward a moral precipice, must be diverted into channels that will convert them into power for good to the individual and to society. This means that encouragement should be given to all associations and agencies that call for active constructive work for and by young people. It means more athletic organizations with activities on land and on or in the water; more intensity in societies for civic betterment; more diligence in literary, musical and artistic pursuits; in short, such a degree of devotion to duty that neither mind nor body will be idle.

Henry Van Dyke is not a physician but he speaks truly in saying: "Diseases are not the only things that are contagious, courage is contagious. Kindness is contagious. Manly integrity is contagious. All positive virtues with red blood in their veins are contagious."

The Boy Scouts and the Fireside Girls are each organizations planned to develop these virtues, kindness, courage, integrity, helpfulness, chivalry and patriotism. When under right leaders they afford a wonderful opportunity for instilling high ideals of conduct whether personal or with reference to the opposite sex.

It should be remembered that real beauty is of the

soul, not of the features, "It is the spirit that giveth life, the flesh profiteth nothing."

In the language of commerce, Love is the Light, Heat and Power of the world; Love only becomes really great when it gets above the passions of youth into the realm of the mind, where are sympathy, affection, respect and devotion, even unto death. The "Titanic" disaster brought out an example of beautiful heroism. The women passengers on the ill-fated ship were being placed in the life boats when one declined to go; instead, clinging to her husband, she said, "We have lived together and we will die together." They disappeared as one.

Solomon was correct in saying:

> "Love is strong as death;
> Many waters cannot quench love,
> Neither can floods drown it."

Sex Axioms

Remember:

False modesty leads to ignorance; ignorance to disease, perhaps to despair.

Lack of knowledge leads to carelessness, carelessness to infection.

Simple infection in one person may become permanent injury to another.

The sins of the father are literally passed on to the child.

Normal sexual instinct is changed by alcohol to sensuality.

"Natural selection" has given place to artificial selection.

Environment (surroundings) is as important as heredity.

Choose character rather than form and feature.

Only a clean person can have clean thoughts.

This is the land of liberty and home of the free.

Every person is at liberty to use self-control,

Every home is entitled to be free from blemish.

"Virtue alone survives."

If this epitome of a great subject gives light or help to any reader, the author is well content. Adieu.

GLOSSARY

Abortion: Untimely birth. Before four months' gestation.

Adenoids: Lymphatic tissue back of the nose. Like tonsils.

Adolescence: Growing up period. Youth. 14 to 21 years.

Anther: Sac on end of stamen holding pollen. Plate I.

Aster: Radiating lines around the centrosome of a cell.

Afferent: Bearing toward, as from the extremities to the brain.

Axillae: The arm pits.

Breed true: Produce young like the parents.

Cell: The smallest unit mass of protoplasm in the body structure.

Centrosome: A minute body of protoplasm near the nucleus of the cell, which appears to control the division of the cell.

Chromosome: The color body formed in the dividing cell. Each species has a definite number of chromosomes.

Cleavage: Division of cell into segments.

Clitoris: Small erectile organ at front of the vulva. Homologous to penis of male.

Coitus: Sexual intercourse between male and female.

Conception: Uniting the male element, spermatazoon with the female element the ovum. Impregnation.

Chorion: Outermost of the membranes enclosing the foetus.

Darwinism: The theory that higher animals develop from lower through natural selection and survival of the fittest.

Determiner: A hypothetical particle of germ-plasm that controls the differentiation of cells.

Dominant: A character that appears in hybrids to the

apparent exclusion of some other character of a parent, as red color dominant to white.

Ectoderm: The outer skin or covering of the embryo. The epiblast.

Entoderm: The inner tissue or membrane of the embryo.

Epididymis: The seminal tubules overlying the testis. Plate XIII, page 57.

Epithelium: The thin layer of cells lining and covering the body.

Eugenics: The science of improving stock by good heredity, well born.

Euthenics: Improving the race by better surroundings, influences, environment.

Eunuch: A man whose organs of generation have been removed.

Fecundation: Making fruitful, adding sperm cells to the ovum.

Fertilization: Making productive; as pollen acts on the ovule and produces fruit.

Foetus: The unborn young in the uterus or womb.

Gamete: A reproductive cell. A spouse.

Gastrula: The embryo when it consists of two layers of cells surrounding a large cavity like a "stomach."

Genitals: The external organs of reproduction.

Gestation: Carrying young in the uterus. Pregnancy.

Graafian Follicle: A small sac in the ovary in which the ovum forms.

Hernia: A rupture or protrusion through a wall, as intestine through the wall of the abdomen.

Heredity: The tendency for offspring to develop like the parent. Heirship.

Hormone: A chemical product of one gland that conveyed in the blood stimulates other glands or organs to activity.

Hybrid: Half breed. Product of parents of different varieties but same species.

Incubate: To lie upon; to sit upon, as upon eggs; to hatch.

Impregnation: Fusion of the male cell (spermatazoon) with the female cell (the ovum)—See *fecundation.*

Inguinal: Region of the groin. See *hernia.*

Lamarkism: The theory that changes in evolution come from active exertion and exercise of the organism; that acquired characters are transmitted.

Mammals: Having breasts or teats. Animals that suckle their young.

Married: Joined for life; wedded to one of the opposite sex.

Metabolism: Chemical changes by which food is converted within the body into tissues or into energy.

Mutations: Unusual variations in inheritance.

Mate (noun)*:* Companion, comrade, husband or wife.

Mate (verb)*:* Join. Form a pair. Birds mate in the spring.

Mendel's Law: The first crossing results in offspring combining characters of the parents; the second cross will result in offspring like each parent in the ratio three to one.

Menses: Months. Hence flow of blood from the womb each month as the egg or ovum matures.

Menstruation: Period of monthly flow, four or five days.

Menopause: Change of life. Cessation of menstruation, at 45 to 50 years of age.

Ovary: Part of female animal in which the eggs are formed. Plate XV and XVII, pages 58 and 66.

Ovulation: Liberation or setting free of the egg.

Ovum: Egg, the female germ or seed.

Parthenogenesis (par-the-no-gen-e-sis)*:* Virgin reproduction without impregnation.

Paresis: Softening of the brain. Dementia.

Pelvis: The arch of bones between the thighs which support the trunk of the body.

Penis: Male organ for uniting the sexes.

Pistil: The female seed bearing part of a flower.

Pituitary Gland: A small gland under the brain that influences the circulation and the sex organs. Influences growth.

Placenta: A plate-like mass of tissue and blood vessels that supplies nourishment to the fetus.

Primates: The first or highest order of mammals; includes man, monkeys and lemurs.

Preformation: The theory that the organism is fully formed in the germ, only requiring to unfold and develop.

Pollen (fine dust)*:* The male element of flowers. Plate II.

Procreation: The act of uniting the male germ to the female germ, the ovum.

Prostate Gland: A gland of the reproductive system lying beneath the bladder. Plate XIV. (Male), page 58.

Prostitution: Offering the body for sexual purposes for wages.

Puberty: The age when it is possible to become a parent.

Reflex Action: Action immediately after stimulation without action of will.

Rodents: A gnawing animal, as squirrels, mice, etc.

Scrotum: The sac of skin surrounding the testes. Plate XIV.

Sex: Distinction of male and female characters.

Semen: A whitish fluid produced by the male generative glands, the important element of which is the spermatozoa.

Stamen: The male organ of a flower that bears the anther and pollen.

Stigma: The part of the pistil that receives the pollen of the flower.

Testis: See testicle. Pages 57 and 58.

Testicle: The gland in males that secretes the spermatazoa.

Thyroid Gland: A shield-shaped gland found in the neck, in front of and at the sides of the wind-pipe (trachea).

Urethra: Canal from the bladder by which the urine is voided.

Uterus: The organ in which the young mammal develops until birth. Plate XV and XVII, pages 58 and 66.

Vagina: The canal from the uterus to the outer genitals or vulva. Plate XV, page 58.

Vas Deferens: The carry-away vessel. Duct from the testicle. Plate XIII and XIV. Male, pages 57 and 58.

Vesicles, seminal: The sac-like reservoirs that hold the generative fluid. Male.

Vulva: External genital organs of the female. Plate XV.

Womb: See uterus.

Weismannism: Theory that heredity depends upon continuity of germ plasm, that acquired characteristics are not transmitted.

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